

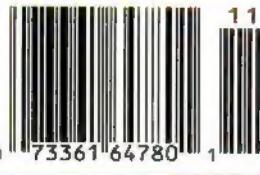
GREENHOUSE: ME, YOU AND CO₂

GARBAGE

The Practical Journal for the Environment

NOV/DEC 89

\$3.95 CANADA \$2.95



Generation to Generation.

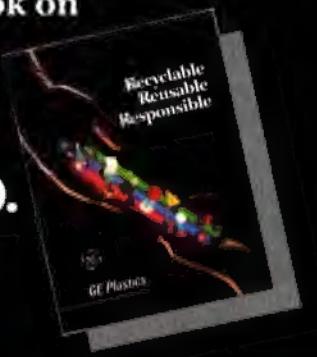
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An old friend saw an early copy of the premier issue. "I love it — you're off to a great start!" he wrote. "My only worry is that you will be successful, and factions will assume things about you or think they own you. Watch out for those who are trying to further their own agendas."

I'm strongly committed to publishing an unbiased journal. But my friend's warning is not unfounded. Assumptions are made immediately: "**GARBAGE** is an environmental magazine. Therefore it must be pro-environmentalist. Therefore it must be anti-something-else." And we're off to the factions.

For example, we're being confronted on our advertising policies. Given the range of complaints, I would say we're in trouble with some people for taking any advertising at all.

Scientific American, *Newsweek*, and others have recently run excellent environmental reporting. Take a look at their advertisers — big, established companies, as you might expect. Yet they aren't getting the kind of flak we are about their advertising policies or business ethics. I think that's because readers see those publications as independent magazines rather than as soapboxes.

We don't pretend to be legislators, activists, or a non-profit group working for a particular cause. Other people are doing those jobs very well: You'll probably see their research, and even their advertising, in our pages. Non-profit organizations owe their existence to a mission; they have bylaws, a board of directors, and a dues-paying constituency to clarify and abide by the stated purpose of the organization.

By contrast, we are a publishing company. Our way of doing business is relatively simple and easy to comprehend: We occupy an editorial niche and readers subscribe and renew according to how well they are being served by the editors. Advertisers in related fields are allowed to purchase space to send a message to those particular readers.

We are unusually circulation-driven, meaning that readers foot most of the bill, not advertisers. We're upfront about the business. You'll notice that ads are placed in the front and back of the book, never in the editorial well (where feature articles run). We don't sell our back cover, because I believe the outside of the magazine belongs to our readers.

Why take ads? The obvious reason is to create a source of revenue beyond subscriptions. That's a good reason: We ran our other magazine as a black-and-white "newsletter" with no paid advertising for its first 13 years, proving it can be done. But when we began to accept related advertising, we were able to afford color pictures, more pages, a newsstand-quality cover — and we doubled our circulation among readers. So the ads do help pay to get the editorial message out to a wider audience.

Ads aren't there only for revenue, however. In a special-interest publication, the ads are a lively source of extra information.

I want our ad policy to reflect real life: big guys and little guys, entrepreneurs filling a niche and everybody making a living. In the real world, not everybody agrees; there's controversy and complication; and the marketplace speaks louder than self-appointed arbiters of morality. By being side by side with small independent companies, by sharing pages with letters from readers, larger companies become part of a community. I can't help but feel that that's more a step in the right direction than divisiveness. Us-against-them thinking isn't helpful.

I am a dyed-in-the-wool editor. I don't doubt that advertising has its manipulators and even its villains. But I truly believe that we get ourselves into very murky waters when

we allow editors to decide who gets to talk to the public.

Hey folks! this is the environment we're talking about! We can't afford an exclusive club: New Age vegetarians are welcome, so is Mobil. Strange bedfellows, you say? (Maybe ... although most vegetarians drive a car.) Let's see what happens when the floor is open.

You still don't feel that all environmental messages are created equal? Then remember the old saying: "Keep your friends close — and your enemies closer."



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Patricia Poore

THE 1990S— THE DECADE OF ENVIRONMENTAL ACTION

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I found your first issue full of very useful and timely information.

Concerning recycling aluminum cans (and foil, etc.) and the 2-liter beverage bottles made of plastic ("Garbage at the Grocery," September/October): My family has been able to avoid the recycling issue. How? We do not buy any soft drinks (or beer, for that matter) in aluminum cans or plastic bottles. We buy fruit juices in glass jars or in frozen form, and do not buy aluminum foil or packaging trays. Thus, our recycling is confined largely to glass, paper, and vegetable matter. We avoid plastic containers as much as possible, although yogurt and shampoo are tough to find in something other than plastic.

Keep up the good work!

Karen N. Klein, M.D.
Carlisle, Penn.

Congratulations! Many of us were probably wondering when someone would get around to beautifying garbage. Your magazine, if it is as good as it sounds, should separate the individual items out of the so-called "garbage" and make society more conscious of each individual item — e.g., dishwashing-detergent bottles, laundry-detergent bottles, the specific plastics these items are comprised of, what happens to these specific items when they are burned or landfilled, how they are manufactured. Explain the specific chemicals and pollutants created when these items are manufactured from a raw material. And so on.

John Vance
Citizens for Clean Water, Inc.
Salem, Ore.

You must have been reading our minds! See "Garbage at the Grocery" on page 34 in the September/October issue. — the editors

I like GARBAGE a lot — its attitude and its contents. I also really enjoy your clear and direct style and your use of type and color and illustration. I am pleasantly surprised to find a publication that answers so many of my questions and is so satisfying in feel and look. Thank you.

Judy Bankhead
San Antonio, Texas

Your new magazine sounds wonderful. I know a lot of people would change their habits if they only knew there were alternatives. Disposable diapers — I'm guilty. In 100 years, we'll all be gone, but my babies' diapers will still be intact somewhere.

Good luck with your "new baby."

Laura Gilday
Aberdeen, N.J.

The format and subject of your new magazine look great! On the basis of our wonderful association with *Old-House Journal* for many years, we are willing to give the new publication a try.

In the near future, we hope to see an article on the latest pollutant/garbage: "low level" radioactive waste. We live in a small rural town (49 square miles, population 1,400), and have been battling the siting of a state nuclear-waste dump (one for all the radioactive waste produced in New York State) for the past eight months. Our major objection is the destruction of our peaceful, rural environment by the pollution of radioactive waste — a product totally foreign to our area....

S. Phyllis Lerwick
Harpursville, N.Y.

This subscription should be considered as encouragement in your venture. Hope you fly!

You did say the magazine would be printed on recyclable paper, didn't you?

Don and Carol Dumond
Eugene, Ore.

Please put me down as a Charter Subscriber to **GARBAGE**. It sounds like a timely, much needed idea.

Incidentally, I hope that in the future, you will print it on recycled paper.

Barbara Brandt
Somerville, Mass.

It is on recycled paper. For a full disclosure, see "Printing Garbage on Recycled" on page 50 in the September/October issue. — the editors

Wow! Your magazine is great! I'm especially excited about the regular food and health article because the link between food, health, and the environment is tremendous. Did you know that it takes 2,500 gallons of water and 16 pounds of grain to create 1 pound of beef? In addition, a feedlot of 20,000 cows (not uncommon)



FILL US IN!

Please give us your opinion on the first issue of **GARBAGE** and drop this postcard in the mail.

My favorite articles _____

My least favorite _____

I want an article on _____

More on what I liked and disliked about the first issue _____

Please write a letter if you run out of room.

One of our favorite response cards, from Susan Morris of Little Rock, Ark.



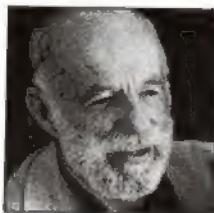
Photo Courtesy Comstock/Tom Grill

According to Dr. Benjamin Spock, breathing can be hazardous to your children's health.

Air pollution is all around us and it hurts children most. Kids inhale more pollutants per pound than adults, and their length of exposure is longer, which increases their risk of permanent damage. Additionally, children under 10 have an increased rate of respiratory infections. When infections are coupled with irritating air pollutants the

damage to young lungs is intensified.

So do what Dr. Spock recommends. Call or write the Public Information Office of the Sierra Club and find out what you can do to help clear the air.



Dr. Benjamin Spock, M.D.

Public Information

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will produce as much waste as a city of 320,000 people. The people's sewage is treated, but the cows' is not, and most of it ends up in our water. The average American man has a 50 percent risk of death from a heart attack, whereas the average strict vegetarian (no meat, poultry, fish, dairy products, or eggs) has only a 4 percent risk. These facts — and many more — are from the book *Diet for a New America* by John Robbins. Robbins devotes one third of his book to the environmental impact of animal-based agriculture. I highly recommend this book to anyone who would like to make a difference every time they sit down to eat. By completely avoiding animal foods, you can save one acre of trees per year. With 85 percent of U.S. topsoil loss directly associated with livestock raising, this connection is no longer an issue we can ignore.

Amie F. Hamlin
Raleigh, N.C.

broader connections; how the throwaway ethic relates to global warming and other environmental travesties, for example. If indeed Americans have attained a deeper awareness of the environment, then your new periodical is sure to find an appreciative audience.

Evan B. Page
Salt Point, N.Y.

Shame on you! Mailing your first correspondence in plastic-window envelopes. Any good recycler knows that these are difficult to process. If recycling is to catch on in America (as it is thankfully beginning to), it should be made as accessible as possible. I hope to see less of these "plastic mailings" in the future. However, I love your idea.

Ariel Ploss
Northfield, Ill.

Yikes, you're right! All the mailing pieces were printed on recycled paper, but we forgot to specify that we didn't want plastic window envelopes. However, our next mailing used envelopes with open windows. — the editors

What a wonderful magazine! You get right to the quick of the problem. People need to know that each and every one of us can make a difference and will make a difference. The hardest part is to take the first step: After that, the ball just keeps rolling.

Martin Cooper
Austin, Texas

Congratulations on the publication of your premier issue, recycled paper and all. Informative, interesting, and understandable apply. You have presented your readers ample options of environmentally concerned action, along with relatively unobtainable insight into health hazards posed in everyday life. All well and good.

I strongly urge **GARBAGE** to fill a void in current environmental publications. The short "Restoration" article on the back cover came anxiously close to the matter I write of: individual efforts made to restore or preserve our biosphere. Though many sources

of information on what can be done are available, I have yet to find one communicating what is being done. Those who make extraordinary efforts to amend the wrongdoing of others, for everyone's benefit, should be acknowledged. It would be reassuring and pleasant to read of problems solved, too. I hope you will take full advantage of your unique opportunity to promote the applied undertakings our endangered planet requires. Doing is of importance.

Duard Headley
Lakewood, Ohio

Congratulations on a very informative and attractive premier issue. I especially enjoyed Janet Marinelli's article, "Garbage at the Grocery." Environmental Shopping, a project of the Pennsylvania Resources Council, was first introduced in 1987. An environmental shopping kit that includes a 20-page booklet, a product list of 400 items in recycled/recyclable packaging, and a poster to be displayed in a participating supermarket is available by sending \$5 to PRC at PO Box 88, Media, PA 19063.

Keep up the good work!

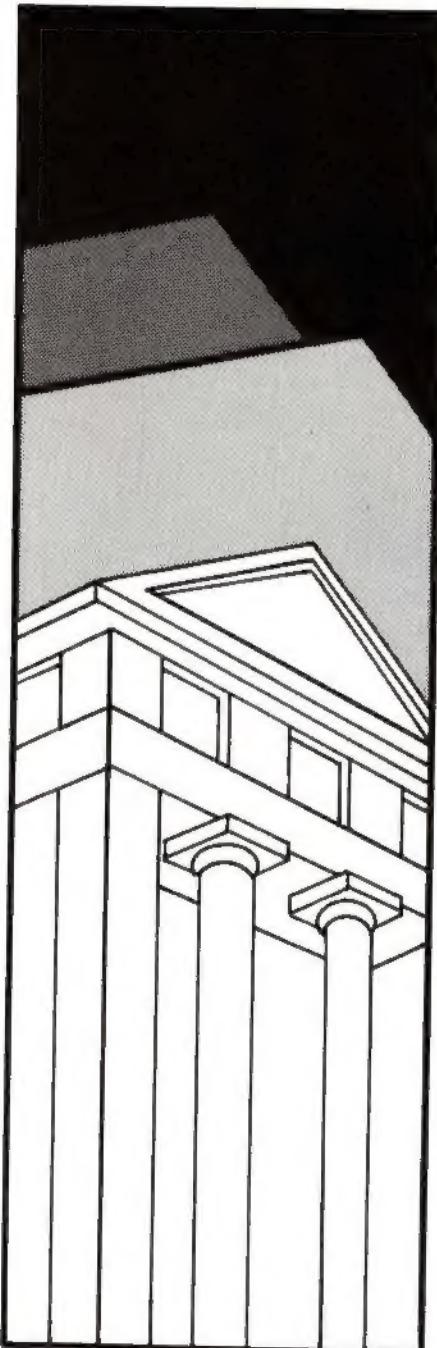
Rachel Chevalier
Penn. Resources Council
Media, Penn.

Please consider including a regular feature on automotive maintenance aimed at increasing mileage and lessening the amount of pollution given off. Currently there are dozens of car magazines aimed at "improving" your car's performance. They are crammed with technical pieces that double or triple your car motor's horsepower, often at a cost of thousands of dollars and tons of hydrocarbons released into the atmosphere. Why not have a regular feature that gets fairly technical but instead shows you how to squeeze every last mile out of a gallon of gas, or features cars that don't run on gas (such as electric cars)? It should be fairly technical because everyone knows they should pump their tires up and get a tune-up. Have a regular mechanic with an interest in the environment write the column.

Matthew Ball
Accokeek, Md.

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Your article "Kitchen Design for Recycling" was impractical for the many of us who are on the lower end of the economic scale because we care about the planet. Redesigning our kitchens (often rented) is not an option. Luckily, there were plenty of other articles.

Additional topics you should cover are over-population; the economy and how it creates refuse (more workers in each household means more convenience packaging, etc.).

Patti DeAngelis
Burlington, Vt.

Regarding the article "Garbage at the Grocery" [September/October] and the question asked, "Is the temper tantrum for paper bags at the checkout counter worth it?", I would suggest that it is not. Recycling paper bags is difficult, and they are rarely made of recycled paper. To give the strength required to support heavy groceries, manufacturers of bags use pulp containing long fibers. These long fibers are present only in virgin paper. Paper bags therefore contribute to deforestation. It would be far better if consumers brought their own tote bags.

Congratulations on the first issue — it looks great. Best of luck with the magazine in the future.

David Marcus
Hamilton, Ont.

Everything was well done. I'd like to read an article on companies who use recycled materials to make their products; industries involved with waste products which give public tours of their facilities: recycle-processing centers, transfer stations, incinerators, etc.

Robin Anderson
Hackensack Meadowlands Development Commission Environment Center
Lyndhurst, N.J.

summers. Each time I return, the mountains of paper and all the unnecessary THINGS I have kept (not newly acquired) make me sick. Dutifully, I send my checks to ecology organizations and cart my papers, aluminum, and glass nine miles across town to our only recycling depot, but that's not going to do it on a global scale, or save this one person's sanity!

Elizabeth Leffingwell
Anchorage, Alaska

Count me in! Yes, indeed, the times are a-changing, and we desperately need practical personal insights, not sermons, on how to deal with the STUFF in our lives. I have travelled on music-related studies (especially Europe) the last twelve

Your great graphics instantly communicate the data in "Garbage Index." Continue your book reviews — perhaps make them even longer. (But please refrain from scatological or sexual vulgarities such as the word "shit" in *How to Shit in the Woods*.) I'd like to see articles on agricultural effluent; hospital waste; the diaper crisis; giardia in water; ocean dumping by commercial ships and navies; biodegradable plastics.

Donald C. Kerr
Turtle Creek, Penn.

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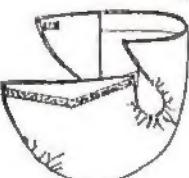
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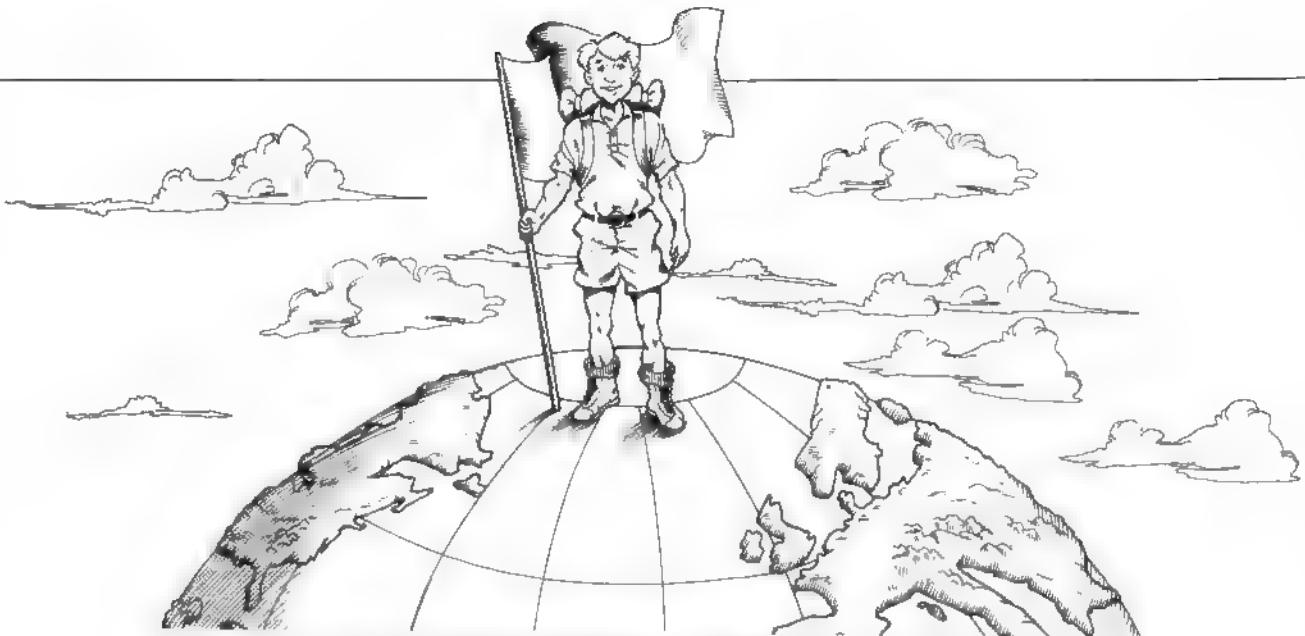
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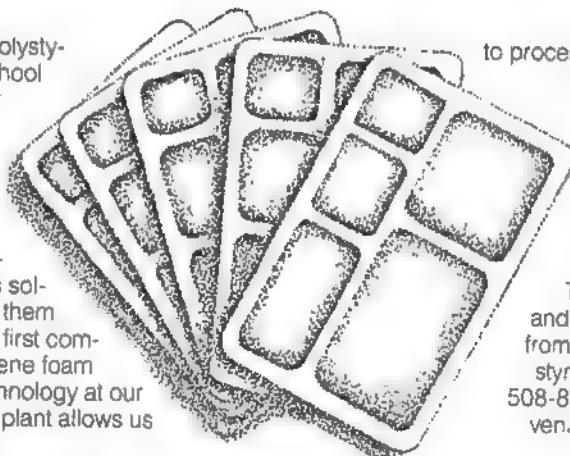
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**Are newspapers toxic?**

Q: I'm planning to put some raised wooden vegetable beds in my garden, but I don't know how to protect the wood from moisture and infestation. I've heard that many wood preservatives contain toxic ingredients and are inappropriate for use in vegetable beds. What should I do?

Anne Resnik
Greenwich, Conn.

Q

I know heavy metals such as lead were once used in newspaper ink. Are these still used? Does newsprint ink pose any health risk to the daily reader?

Elizabeth Larsen
Chicago, Ill.

A

Standard black ink consists of mineral oils and carbon black, and is fairly innocuous. Until 1981, lead, a potent neurotoxin, and cadmium, a known carcinogen, were often used as pigments in newsprint ink. Although the government never banned the use of heavy metals in newsprint ink, the American Newspaper Publishers Association (ANPA), whose membership accounts for 90 percent of U.S. daily newspaper circulation, convinced the National Association of Printing Ink Manufacturers to stop using lead, cadmium, and chromium in ink sold to member publishers. Both organizations then devised guidelines for the development of environmentally acceptable pigments. Colored inks, many of which are derived from minerals and clay, receive an ANPA approval seal if tests by the group's hygienists and chemists show that the inks will not adversely affect printing-factory employees, subscribers, or the environment.

For most people, sitting down with the

A: You've heard correctly. Ninety-seven percent of the wood preservatives used in this country are made from either creosote, pentachlorophenol, or inorganic arsenicals—all hazardous chemicals that can leach into soil and be absorbed by plants. Pentachlorophenol, for example, has been shown to cause birth defects in the offspring of laboratory animals.

The safest way to make sure vegetable beds last is to build them out of woods such as cypress, redwood, and cedar, which are naturally rot-resistant. Although these wood varieties are costly, they're the only way to completely avoid using chemicals on raised vegetable beds.

An alternative is to coat your raised beds with copper naphthenate (CN), a low-toxicity wood preservative available in some home-repair and hardware stores. Lisa M. Scott, horticulturist and technical specialist at Appropriate Technology Transfer for Rural Areas, an educational resource center specializing in organic agriculture, points out that while vegetables grown in CN-treated wood would not qualify as certified organic in most states, the preservative doesn't migrate significantly into the soil and consequently will not be absorbed by your plants.

You'll need to apply copper naphthenate to wood approximately every three years. Wear a mask, and work in a well-ventilated area.

Q: What's the latest news on passive smoking? Can you develop lung cancer from spending too much time around smokers?

Jon Jensen
Brooklyn, N.Y.

A

A: Because there is no filtering effect on the smoke from a burning cigarette, it contains twice the amount of tar and nicotine of the smoke the smoker inhales. The most conclusive studies have found that non-smoking women who live with smoking men over a 10- to 20-year period have a higher risk of developing lung cancer than women who live with non-smokers. The U.S. Environmental Protection Agency estimates that, in general, the risk of developing lung cancer is roughly 30 percent higher for non-smoking spouses of smokers than for non-smoking spouses of non-smokers. The Surgeon General's Office attributes about 5,000 cases of lung cancer per year to involuntary smoking.

Prolonged exposure to sidestream smoke contributes to other respiratory health problems as well, including chronic bronchitis.

How about his smoke?**GOT A QUESTION?**

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Two decades ago, we sponsored "Begin in Your Own Backyard," a local clean-up and beautification program with Keep America Beautiful, Inc.

In the late 1960s, we initiated the "New York City Experiment" with their Sanitation Department and demonstrated that curbside plastic bag pickup was cleaner, safer and quieter than metal trash can collection.

During the 1970s, we worked closely with the U.S. Environmental Protection Agency to produce an information program to help city sanitation managers better understand disposal options.

Since the mid-1980s, we have built on our partnership with Keep America Beautiful, Inc. to sponsor local clean-ups nationwide. The "GLAD Bag-A-Thon® Program," a public/private sector effort, has now grown to 69 cities. In 1989, 318,000 participants bagged 16 million pounds of litter. They collected and bagged an additional two million pounds of recyclables, including plastics.

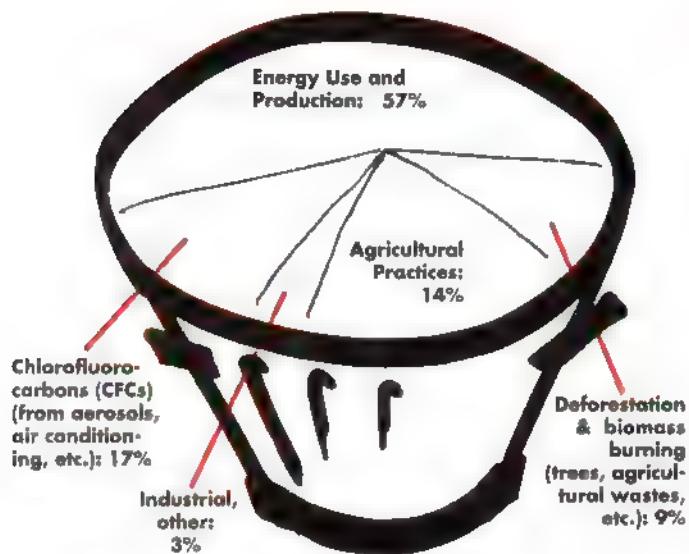
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CONTRIBUTIONS OF VARIOUS SOURCES TO GLOBAL WARMING WORLDWIDE



Source: EPA

HOW COUNTRIES COMPARE

Estimated contribution of CO₂ emissions to the greenhouse effect from fossil-fuel burning:
49 percent

Estimated contribution of CFC emissions:
17 percent

CO₂
(1987, in millions of tons)

USA	4480
USSR	3711
W. Europe	2899
China	2031
Japan	908

Source: Oak Ridge National Laboratory/Worldwatch Institute

EPCs
(1986, as percent of total emissions worldwide)

USA	29%
Other industrial countries*	41%
Soviet Union, Eastern bloc	14%
Other developing countries	14%
China and India	2%

* Western European community accounts for more than half, followed by Japan, Canada, Australia and others.

Source: Worldwatch Institute

GLOBAL WARMING

Amount of carbon per year absorbed by one acre of trees:

4 tons

Source: Renew America

Number of acres of rainforest razed each minute:

50

Source: Rainforest Alliance

DEFORESTATION*

Six states with greatest forest loss during the past decade
(listed as percentage of forest land lost)

Nebraska: 30%
Hawaii: 12%
Arkansas: 7%
North Carolina: 6%
Oregon: 6%
Washington: 6%

REFORESTATION*

Six states with greatest forest gain during the past decade
(listed as percentage of forest land gained)

Ohio: 20%
Nevada: 16%
Indiana: 13%
Illinois: 12%
New York: 9%
North Dakota: 9%

*Data on Alaska not available
Source: Renew America

CARBON IN CARS

Amount of carbon released per year by cars worldwide:

547 million metric tons

by American passenger cars in 1988:

202 million metric tons

by American cars and light trucks in 1988:

260.42 million metric tons

Source: Worldwatch Institute, American Council for an Energy Efficient Economy

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“Hazardous-waste management isn’t like making jellyrolls. The risks are enormous, but the profits can be commensurate with them.”

Richard Fortuna,

Executive Director of the Hazardous Waste Treatment Council, on the windfalls to be made from cleaning up the 300,000,000 tons of toxic waste produced in the U.S. each year.

(Newsweek, October 3, 1988)

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John Suter,

resident of Chugiak, Alaska, on the effects of last spring’s Exxon oil spill.
(Anchorage Daily News, April 23, 1989)

URBAN STRESS TEST

Hooked on life in the big city? A recent ranking of 192 U.S. cities with populations generally over 100,000 determined that smaller cities tend to have better air and water quality, fewer problems with industrial hazardous waste, and better sewage systems than their megalopolitan counterparts. Here’s the list of the five best and worst cities to live in:

The Best Cities

Abilene, Tex. (population 112,430)

Roanoke, Virg. (101,900)

Winston-Salem, N.C. (148,080)

Berkeley, Calif. (104,110)

Billings, Mont. (80,130)

The Worst Cities

Phoenix, Ariz. (population 894,070)

Salt Lake City, Utah (158,440)

Houston, Tex. (1,728,910)

Jersey City, N.J. (219,480)

Philadelphia, Penn. (1,642,900)

Illustration Scott Willis



GARBAGE DICTIONARY

beach whistles, noun (plural). Plastic tampon applicators which wash up on beaches and have become a significant source of shoreline blight. Partial credit for the term should go to Jay Critchley, a Provincetown, Massachusetts, artist. About ten years ago, Critchley decided he'd seen one too many of those nearly indestructible applicators on Cape Cod beaches, so he began publicizing the problem by creating sculptures from (what else?) plastic-tampon debris. The artist claims the phrase originated around that time. But beach-whistle pollution really made it big in 1986, when Critchley attended the Statue of Liberty Centennial in a gown rustling with 3,000 pink and white plastic tampon applicators (see photo at right).

Rumor has it that kids are just as creative in their use of discarded applicators. Some mount them on sand castles, some wear them as finger puppets, and others use them (literally) as whistles.

New Jersey environmentalists deserve some credit for the term beach whistle, too. In the late 1970s, an estimated 1,000 plastic tampon applicators were dumped with sewage sludge off the coast of New York and New Jersey every day. According to the Center for Marine Conservation, a Washington, D.C.-based group specializing in coastal pollution, that number is considerably higher today. However, old sewage systems, which combine runoff from street sewers with toilet wastes, and therefore often overflow during downpours, are the biggest source of beach whistles. The Center says plastic tampon applicators are a problem from coast to coast.

-Janet Marinelli



Photo: courtesy Jay Critchley

• EPA'S PESTICIDE PANEL •

The Environmental Protection Agency's review of Alar, the chemical ripener used primarily on apples (see "Lifting the Lid" September/October), has opened up more than one can of worms. First environmentalists and consumer advocates claimed that EPA's delay in banning the suspected carcinogen reflects inadequacies in the way the agency evaluates health and safety data. Now Senators Harry Reid of Nevada and Joseph Lieberman of Connecticut have called for an investigation into possible conflicts of interest among members of the EPA's Scientific Advisory Panel (SAP) that reviewed Alar.

The SAP is an eight-person panel comprised of toxicologists, pathologists, environmental biologists, and scientists who analyze information on the health and environmental impacts of pesticides. They report their conclusions to the EPA administrator, who makes the final decision on whether a pesticide should be

classified as a potential cancer-causer or be banned. Panel members are nominated by the National Science Foundation and the National Institutes of Health, then appointed by the EPA administrator. During their two- to five-year tenures, SAP members pass judgement on the safety of many pesticides.

In a letter drafted to EPA Administrator William K. Reilly in May, the senators claimed that seven of the eight panel members who reviewed Alar had worked as consultants to the chemical industry during their tenure and may have violated EPA regulations as well as federal ethics codes governing the activities of federal employees after they leave their posts. The senators also pointed out that one panel member consulted for Uniroyal, the manufacturer of Alar, soon after completing his term on the SAP, and that another served as an expert witness for growers in the Pacific Northwest who sued the EPA for

instituting an emergency suspension on dinoseb, another Uniroyal chemical.

The senators have also asked the EPA to explain how it reviews the backgrounds of potential SAP appointments. And they want the EPA to closely monitor the activities of panel members during and after their appointed terms. As EPA regulations now stand, SAP members are barred only from participating in a decision on a chemical during a year they have received money from that chemical's manufacturer.

To date, the EPA has not formally addressed any of the senators' concerns and will not comment on the investigation of the Alar SAP members. Spokesmen claim the matter is "under review." However, the executive secretary to the panel has stated that the senators' requests are being taken into consideration as two new panel members are presently being selected.

—Ginia Bellafante

PROFILE

Trash Mavens with a Mission

Across from several now defunct landfills in New Jersey's Hackensack Meadowlands — a name synonymous with garbage for over 50 years — lies an unusual new museum. The brainchild of Anne Galli, director of the Hackensack Meadowlands Development Commission Environment Center, and Robin Anderson, a former teacher, the museum is the first to spotlight that gross amalgam of stuff we call garbage.

When Galli and Anderson (pictured at right) designed the three-room gallery with a team of designers, educators, and set builders, their intention was to show people what really happens to garbage. "Many of us think it disappears magically," says Robin Anderson. But the truth is it just piles up. The museum's entry room is a dramatic introduction to our garbage problems. Galli and Anderson commissioned artists to rummage through trash cans for garbage to feature in the display. The dark, cave-like room gives visitors the sense that there is no escape from the mounting heaps of debris we produce.

Adjacent rooms feature dioramas that show us how we got into the garbage mess, and what we can do to get out. One exhibit provides peepholes for visitors to peek into a cartoonlike American kitchen where Mom, Dad, and the kids are all blindly tossing plastics, banana peels, and cans and bottles into overflowing trash bins. A biodegradation display gives viewers an idea of what various objects look like after 100 years in a landfill. Instructional boardgames on composting and recycling are available to play with and a colorful showcase presents environmentally sound alternatives to common products.

The museum will have a special appeal for kids. Galli and Anderson hope that the 14,000 school children expected to saunter through the museum during the 1989-90 school year will leave ready to renounce microwavable brownies and aseptic juice boxes for good. The museum is open to class trips during the week and to individuals on weekends.

—Ginia Bellafante



Photo: Janet Marinelli



Illustration: Dick Wallmeyer

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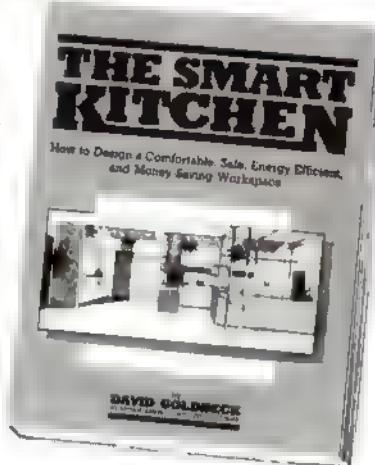
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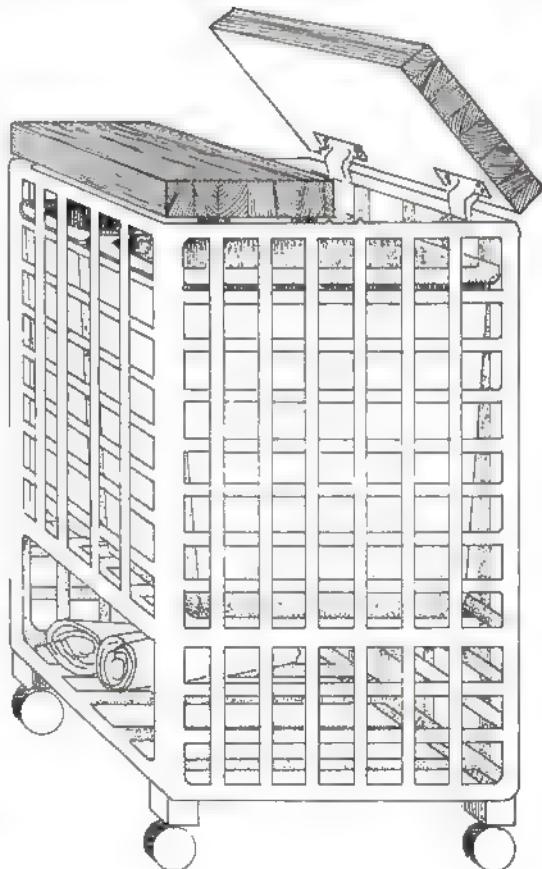
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HERE'S A SUMMARY OF THE PROBLEM – FOLLOWED BY ARTICLES THAT TELL YOU & ME WHAT WE CAN DO ABOUT IT.

GLOBAL WARMING

It's not "them." It's "us."

T

The greenhouse effect became a household term last summer, when drought and record-breaking temperatures got our attention. We heard on the news that levels of carbon dioxide, chlorofluorocarbons, and other "greenhouse gases" are increasing. A parade of scientists appearing before Congressional committees warned what this *could* mean: melting ice caps and rising sea levels that would inundate coastal cities and drown thousands in fierce storms, rainfall shifts that would make deserts bloom and turn breadbaskets into dust bowls, unnatural heat everywhere. Earlier this year, we learned that 1988 joined 1980, 1981, 1983, and 1987 as the five hottest years of this century.

What nobody focussed on was that *we're* to blame. *The fossil fuels believed to be largely responsible for the increase in greenhouse gases keep our cars running and our houses warm in winter. And the chlorofluorocarbons (CFCs) that have been linked to global warming are in the air conditioners that keep us cool in summer and the refrigerators that preserve our food year round.*

If we're serious about doing something about global warming, we have to take stock of our lifestyles. *The greenhouse effect is not the result of something gone wrong, like the illegal dumping of industrial poisons, or the nuclear accident at Chernobyl. It's the result of normal, everyday life.*

* AN INTRODUCTION

The atmosphere is changing. That much we know for sure. Since 1958, levels of carbon dioxide (CO_2) have increased from 315 to 350 parts per million by volume. Until 1928, CFCs didn't exist. CO_2 levels are up about 25 percent from pre-industrial times, and are expected to be double the preindustrial level in about 50 years. Levels of CFCs in the atmosphere are increasing faster than any other greenhouse gas.

A greenhouse effect has existed since we've had an atmosphere, and that's good. Earth can be seen as a giant greenhouse that receives heat from the sun, radiates some back into space, and traps enough in its atmosphere to maintain a livable climate. Without any greenhouse effect, the Earth would be 60 degrees cooler – far less livable, to say the least.

The concern is that the activities of you and me and the billions of other people on the planet are adding CO_2 , CFCs, and other heat-trapping substances to the atmosphere in such quantities that life as we know it may change.

What scientists agree on:

- Global warming due to the man-made emissions of these heat-trapping gases is almost certain and may already have begun.
- Average global temperatures have gone up 1 degree Fahrenheit over the past century.
- If greenhouse-gas emissions continue to grow, we're headed for substantial climate change in the decades ahead.

What scientists disagree on:

- Why temperatures are up 1 degree over the past century. James Hansen, head of the NASA Goddard Institute for Space Studies, is the leading proponent of the opinion that this observed global warming is "consistent with the expected warming from the growth of greenhouse gases in that time," as he wrote earlier this year in *The New York Times*. In other words, the greenhouse effect is changing our climate right now.

Andrew Solow, a statistician at Woods Hole Oceanographic Institution in Massachusetts, is a voice for the opposing view. "The current warming," Solow wrote in the *Times* late last year, "is consistent with a mild post-glacial period, probably the aftermath of the so-called 'little ice age' that ended during the 19th century."

- What the exact ecological consequences of global warming will be.

Using advanced computer models, scientists are trying to make predictions. These models are steadily improving, but they're still crude approximations of the atmospheric system and how it interacts with other natural systems, especially the oceans. Scientists disagree on how much the Earth will warm, or how fast, or how the warming will affect individual countries or regions.

Most scientists estimate the Earth will warm 3 to 9 degrees Fahrenheit in the next century if we don't drastically cut emissions of the greenhouse gases. A recent study by Daniel Lashof, an environmental scientist at the Environmental Protection Agency, contends temperatures could rise 6.3 to 11.3 degrees or more over that time. (To give some perspective on these seemingly small numbers: The Earth has warmed only about 9 degrees since the last ice age, when much of the U.S. was buried under a glacier.)

Three of the computer models used to gauge the effects of a doubling of greenhouse gases in the atmosphere differ in their predictions of U.S. rainfall shifts. Two models show an

increase in summer rainfall in the Southeast...but one shows a decrease. A different two show a drop of rainfall in the Great Plains...while the third shows an increase. Still another combination of two models shows an increase of rain in California, while the third indicates a drop.

Nevertheless, there is little disagreement that one to three degrees of warming are inevitable because of past greenhouse emissions.

• THE GREENHOUSE GASES

Over 99 percent of the atmosphere is made up of oxygen and nitrogen, which don't trap radiant heat. But certain trace gases and man-made chemicals do.

• **Carbon dioxide.** Scientists estimate that CO₂ causes about 49 percent of any greenhouse effect. **CO₂ concentrations are increasing at a rate of about 0.4 percent a year, primarily from the burning of fossil fuels in power plants, factories, and family cars.**

• **Methane.** The concentration of methane has more than doubled during the past three centuries. It's increasing at a rate of 1 percent a year and is estimated to produce about 18 percent of the greenhouse effect. A small part of this comes from the use or production of fossil fuels. But scientists believe most of the increase is due to rice cultivation, population increases and animal husbandry (animals produce methane as a byproduct of digestion), landfills, and coal seams.

• **Chlorofluorocarbons.** Another 14 percent of the greenhouse effect has been linked to CFC-11 and CFC-12. These two manufactured chemicals, used mostly in aerosols, foams, and refrigeration, are already restricted internationally because there is evidence that they are destroying protective ozone in the upper atmosphere.

• **Nitrous oxide.** The concentration of nitrous oxide has increased by 5 to 10 percent since before the Industrial Revolution. Just why is unclear. Scientists suspect that the use of nitrogen fertilizers and fossil-fuel burning are largely to blame.

Emissions of carbon monoxide (CO) and nitrogen oxides (NO_x), also from fossil-fuel burning, and CFCs other than CFC-11 and CFC-12 are also changing the chemistry of the atmosphere.

• WHAT WE CAN DO

Discussions about how to control the greenhouse effect focus on carbon dioxide (because it's the most abundant greenhouse gas) and CFCs (because they're increasing fastest and last so long in the atmosphere).

The 46 signers of the Montreal Protocol have agreed to cut CFC levels in stages, to 50 percent of 1986 levels by 1999. But the EPA claims that emissions of CFC-11 and CFC-12 will have to be cut 75 percent and 85 percent, respectively, just to stabilize concentrations in the atmosphere. The search for substitutes is underway. For now, we'll have to live with the CFCs in our refrigerators. But we can cut down on our use of air conditioners, particularly in cars (see page 30).

We've also got to cut down on the amount of CO₂ we spew. That means cutting down on the amount of energy we use at home and in our cars. It also means switching to fuels, like natural gas and solar, that produce less carbon dioxide than coal or oil.

About one-third of the energy consumed in this country

goes into our homes and cars. Amory Lovins, one of the nation's leading energy experts, says the average American home has one square yard of holes in it. We made our homes more energy efficient in the wake of the energy crises of the 1970s, but there's still plenty of room for improvement. Craig Canine has been writing about the tough energy choices we're faced with for years. We asked him to write an article for our special section with practical tips on how we can all slash our home energy use, and our fuel bills, in half—or more. His article begins on page 20.

The other thing we can all do about global warming goes to the heart of America's long love affair with the car. Cars and light trucks (Blazers, Toyota pickups, and the like) use more oil than any other sector of the U.S. economy. We've got to use our cars more efficiently. Many of us could take the bus. And when we buy new cars, fuel efficiency should be at the top of our list of "options." The technology already exists to make cars that get 50 mpg or more. But auto makers are right when they say that nobody is asking for them. Yet. (My article on cars begins on page 28.)

There are no simple remedies for global warming. But it could be worse. There's plenty of room for energy efficiency in the American economy. Germany and Japan, the other major industrial powers, use energy twice as efficiently as we do. As a nation, we're the single largest contributor to the atmospheric build-up of CO₂ from the burning of fossil fuels. **Although only 5 percent of the world population, Americans are responsible for roughly 20 percent of the estimated global greenhouse effect.** We get all steamed up about the destruction of the Amazon rain forest, another suspected cause of global warming. But CO₂ from our cars alone is equal to all of Latin America's CO₂ emissions from all sources, according to the World Resources Institute, an environmental think tank. And so many anti-greenhouse measures have beneficial side effects. We'll reduce our dependence on foreign oil. Our trade deficits will go down. It won't cost as much at the gas pump. Our home heating bills will plummet.

Still, why bother if there's a chance that global warming is as likely science fiction as fact? Recently, the Beijer Institute in Stockholm, and the United Nations Environment Programme, and the World Meteorological Organization, and the Environmental Protection Agency, and the Woods Hole Oceanographic Institution—groups not known for using scare tactics—have concluded that **the threat of global warming is so grave, we shouldn't wait around for irrefutable evidence.**

While scientists debate, policymakers quibble about whether we need a gasoline tax or a "carbon" tax (which would tax high-CO₂ fuels higher than low ones). Some analysts conclude that such a tax is necessary, arguing that the fuel standards enacted by Congress in 1975 (when new cars got an average 14 miles per gallon) worked because "market pressures" (the high cost of gas) and regulatory requirements worked together. But oil prices dropped in the mid-1980s, and we went back to buying gas guzzlers, they say.

It will take government incentives to prod us to conserve fossil fuels once more. And industry will have to do its part. But what the experience of the 1970s says to me is that in the face of the energy crises, we all got to work and dramatically improved the energy efficiency of our homes and cars. Today we're faced with a more intractable problem than OPEC. We did it once. We can do it again.

—Janet Marinelli

HOME ENERGY

In the '70s, we weatherstripped to save money. In the '90s, our goals are more long term. The remedies are still simple—and they'll still save you money.

BY CRAIG CANINE



In Iowa, talk of drought is far more common than discussions about global warming. When the corn leaves were curled up like spiky pineapple tops in the summer of '88, you couldn't sip a cup of coffee in a small-town cafe without overhearing remarks about how badly the crops needed rain. Occasionally, talk of the two-year drought would turn to speculation about its causes. Are weather patterns changing? Is this hot, dry weather a fluke—or is it a new fact of life? "May as well leave the planter in the shed next spring if this is the way it's going to be," is one variation of a commonly heard theme.

But some Iowans aren't just talking around the subject of global warming. They're doing something about it.

When Collin Myers, a high-school science teacher, took a job in the little Iowa town of Osage in 1979, he found a battle brewing in the teacher's lounge. The crossfire was friendly, however—just a little monthly competition to see who could bring in the lowest energy bill. As soon as Myers bought a house in Osage, he joined in the fray.

His house, a modest, '60s-vintage ranch with a second storey and a family room added on, offered plenty of room for improvement. The first year's utility bills, including natural gas and electricity, added up to \$2,100. The man to beat—social studies teacher Richard Woodruff—consistently brought in fuel bills half as big. The gauntlet had been tossed to the ground, and Myers went to work.

Osage, he soon learned, is blessed with a municipal utility that goes to extraordinary lengths to help its customers conserve energy. For example, the utility encourages Osage residents to borrow one of several plug-in electric meters, which show how much electricity household appliances use. Myers plugged his refrigerator—an old side-by-side model—into one of the meters. "I discovered that it was eating up about 30 kilowatt-hours a day," he says. "So I sold it for \$200 and bought a new one for a net investment of about \$180. The newer one uses less than 10 kilowatt-hours a day, so it paid for itself in a year."

Shortly after that, the Osage utility took infrared pictures of every house in town. The pictures showed, in stark black and white, the location and severity of heat leaks. Myers' home proved to be "pretty leaky" in his own judgement—

especially the family room addition. "When I needed to reside the house," he recalls, "I tore off the old siding, nailed on a layer of rigid-foam insulation, then put up new siding. I put rigid foam on the inside of the leaky addition, which I caulked and taped to the windows. We also got new storms for all the windows, and a new, insulated front door."

A subsequent infrared scan showed that Myers had cut his heat losses dramatically. The change was especially evident in the addition. "When we saw how much good it did to tighten up the windows in the family room," he recalls, "we took out the trim around all the rest of the windows and caulked them, too." He also replaced the electric stove with a gas range, and changed some 200-watt outdoor floodlights with new 75-watt concentrating bulbs that produce the same amount of illumination as the old bulbs, but with less than half the electricity.

When one of the other teachers in town installed a high-efficiency gas furnace and water-heater unit, Myers saw the resulting drop in his colleague's utility bills and bought one of the units (an Amana model) himself.

In short, Collin Myers transformed his house from a flabby energy-guzzler into a svelte energy-sipper. He trimmed 60 percent off his electric bill, and his gas bills went down 50 to 60 percent—after he added a gas stove. "I made a graph of my electrical usage," says Myers, "and it went down stepwise with every major improvement, just as pretty as you please. When you save \$1,000 a year on your energy bills, the payback on your efficiency investment goes pretty fast."

• SWEET MEDICINE

The energy show-and-tell sessions in the Osage High School teachers' lounge started as a fun way to compare home fix-up notes and save money on utility bills. The teachers' motivation was benign self-interest. But in a modest way, their energy-conserving home improvements are also benefitting the world. For every kilowatt-hour and Btu they shave from their home energy consumption, they are reducing the amounts of carbon dioxide (CO_2) and other so-called greenhouse gases that are dumped into the atmosphere at their behest. By cutting their home energy consumption roughly in half, Collin Myers and other Osage residents have accomplished what several studies say must be done by all of us to forestall what could be the worst global catastrophe short of nuclear war.

Craig Canine is a freelance writer and part-time farmer living in Iowa. His articles have appeared in Newsweek, Harrowsmith, The Atlantic, and other publications.

Since the late 1970s when President Jimmy Carter urged Americans to wage "the moral equivalent of war" and conserve energy to reduce our reliance on foreign oil, the energy efficiency of the average U.S. home has improved. But for the past couple of years, conservation efforts have stalled, and there's still plenty of room for energy improvements. Most American houses still waste half the energy they consume. Not surprisingly, improving residential energy efficiency ranks high on the list of policies Congress is considering in its response to the global-warming crisis. In a report Congress requested from the U.S. Environmental Protection Agency (EPA), the agency's Office of Policy, Planning, and Evaluation identified several measures that would, if put into place by the year 2000, substantially reduce the severity of global warming over the next century. One of those measures was a reduction in U.S. residential and commercial energy use by as much as 75 percent for fuel and 50 percent for electricity.

What would it cost homeowners to cut their domestic energy consumption in half—not just in terms of money, but also in convenience and comfort?

Many people associate energy efficiency with austerity. One of these people is former President Ronald Reagan, who, in 1986, defined energy conservation as "being too hot in the summer and too cold in the winter." This may have been true in the 1950s, before many people knew or cared much about energy conservation. But today, conservation doesn't have to mean getting by with less. It means accomplishing the same things with less energy. Contrary to the former president's quip, conservation can mean being *colder* in the summer and *warmer* in the winter. Today's most efficient homes tend to be the most comfortable, as well, because they have fewer drafts, cold spots, and fluctuations in temperature resulting from widely cycling heating and cooling systems.

The simultaneous improvements in the efficiency and comfort of houses are due, in large measure, to advances in our knowledge of how to construct buildings that hold in heat or cooled air. At the same time, manufacturers of furnaces, air conditioners, refrigerators, and other major home

appliances have learned how to make their products use less energy to perform the same amount of work. A new home that takes full advantage of all these technologies (such as most new houses built in Sweden—see page 23) is more than twice as energy-efficient as the average American house.

What's more, efficiency is the sweetest of medicines, since a good many conservation measures have a *negative net cost*. That means they not only pay for themselves, but they pay dividends in reduced energy costs. In fact, many investments in energy efficiency get better returns than anything Wall Street has to offer. "Some home energy-efficiency improvements offer a return-on-investment of 20 percent per year," says John Krieger, a technical specialist for the National Appropriate Technology Assistance Service (NATAS), an information service sponsored by the U.S. Department of Energy. "That kind of return isn't available to most people in any other way." Efficiency investments also pay off in increased property values.

So where do we start?

• DO YOUR OWN ENERGY AUDIT

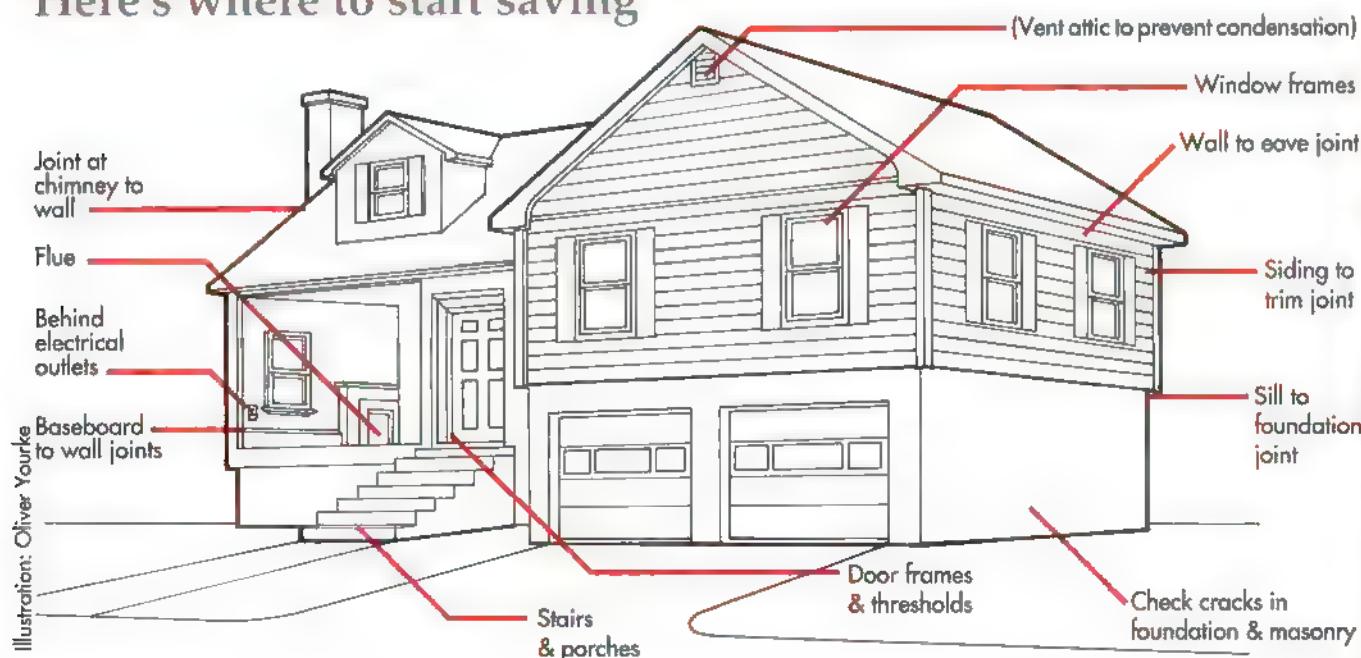
Every house is different. So efficiency measures that make sense in one home may rank low on the priority list for the house next door, let alone a house in a different climate zone. You can hire a professional "house doctor" to do a thorough analysis of your house and then prescribe an individualized energy-fitness program. Such "house calls," however, can cost up to a few hundred dollars. Some utility companies offer home energy audits free of charge, but the quality of these free audits varies widely.

You can also do an audit yourself. Your results may not be as detailed as those generated by a professional armed with specialized tools and computer software. But with a few clues and guidelines, you can identify and fix your home's most glaring energy loopholes yourself.

To set your priorities, it's useful to know just where energy is used in the typical American house. Space heating

POINTS OF INFILTRATION

Here's where to start saving



hogs the largest slice of the home-energy pie, accounting for more than 50 percent of a typical house's consumption in cold climates; 20 to 40 percent elsewhere. Water heating comes next, claiming a 16-percent share of the total, followed by refrigerators and freezers (12 percent), air conditioning (8 percent; more in hot climates), lighting (7 percent), and cooking (6 percent). All other energy uses, including clothes drying and home entertainment, add up to about 11 percent.

It's wisest to make improvements starting at the top of the energy-consumption list, addressing space-heating efficiency in cold to moderate climates and cooling efficiency in hot climates. Then work your way down to progressively less energy-intensive household needs.

• TIGHTEN UP

Opportunities for improving space-heating efficiency fall into two categories best described with terms borrowed from economics: "supply-side" and "demand-side." Supply-side improvements include having your furnace cleaned, or replacing it with new, high-efficiency equipment. Demand-side fixes include anything that reduces the amount of heat energy needed to keep your house comfortable, such as adding insulation and stopping drafts.

Demand-side improvements are the most popular line of attack for do-it-yourselfers, but a good many homeowners have misconceptions about which places to attack first.

Windows



Illustrations: Patricia Power

Roger Harris, Technical Director of the Hampden County Energy Office in Springfield, Massachusetts, has performed hundreds of home energy audits. He's watched the replacement-window business boom since the energy crises of the 1970s, as Americans have tried to tighten up their homes.

But Harris claims that replacing old windows is one of the most overrated ways to conserve energy at home. If your existing windows are in good working order and you have serviceable storms, replacing them with standard double-glazed windows simply isn't cost-effective. And homeowners who've replaced their windows often complain of an increase in condensation. This happens because putting in new, double-glazed windows usually tightens up the house, but it doesn't improve the insulation level of the glazing area, as measured in an R-value rating, which is a coefficient expressing the rate of conductive heat loss in a wall or window (the higher the R-value, the lower the rate of heat loss). Tightening the house traps more moisture-laden air inside, which condenses on the windows because the inner glass surface is still below the dew-point temperature.

It's more cost-effective to put in double-pane units with a low-emissivity (low-E) coating, or low-E units filled with argon gas. Low-E window coatings, an exotic technology a decade ago, are now virtually standard with major window manufacturers such as Andersen, Marvin, Pella, and Crestline. The cost of a standard casement or double-hung model fitted

with low-E glass is often no greater than the cost of the same window with regular glass. A low-emissivity coating is an invisible, microscopically thin metallic layer that typically lets the sun's warming infrared rays stream into the house, but won't let them back out. This property effectively doubles the R-value of a typical double-glazed window from R-2 to around R-4.

If, in addition to having a low-E coating, the cavity between a double-glazed window's layers of glass is evacuated and replaced with a gas such as argon, which conducts heat less readily than air, then the window's R-value jumps up to R-6 or more. But the argon option is costly; for now, it doesn't make sense except to gonzo energy buffs who live in northern climates.

Even simple low-E windows have a long payback: It takes about 30 years to recover their cost through energy savings in New England, and probably 50 years in areas with milder winters, such as the lower Midwest. You almost have to justify an investment like that in terms of aesthetics, ease of cleaning and maintenance, and increased comfort—not just in terms of energy savings.

Weatherstripping and Caulk



Another common energy fix on Harris's "overrated" list is weatherstripping for windows and doors. Not overrated because it doesn't work (it does); just that it's not enough. Tests have shown that windows and

doors account for only 15 to 25 percent of a house's total air loss. The rest, accounting for a majority of total infiltration (air coming in) and exfiltration (air going out) losses, comes from more subtle leaks, especially in basements and attics. Cold air that enters the house through leaks in the basement or attic is often channeled into the house through hollow partition walls that are riddled with electrical outlets, gaps behind moldings, and penetrations for plumbing and wiring.

Hunt for these hidden heat leaks on a cold, windy day. Feel for drafts with your hand, or use a lighted stick of incense and watch the smoke. In the basement, be especially vigilant around windows and up near the sill plate—the place where concrete meets wood around the top perimeter of the foundation. Look for leaks in the attic, too, unless it's deliberately ventilated, insulated, and sealed from the living quarters below. Prime attic checkpoints are areas around hatches, plumbing vents, chimneys, and other roof or wall penetrations. Inside the house, feel for cold air coming from around baseboards and other trim, through outlets and switch covers, and below kitchen and bathroom sinks where pipes come up from the basement.

Before you begin your search for air leaks, put together a kit of materials with which to plug them. Your prime tool will be a caulk gun and a few tubes of high-quality, siliconized or urethane caulk (such as Elmer's siliconized acrylic latex caulk, about \$3 per tube). Also take along a damp rag or sponge to clean surfaces so the caulk will adhere well. For larger gaps, a foam sealant such as "Great Stuff" will come in

handy. (It's available in most hardware stores and home centers for about \$5 per can.) But be sure to clean it off skin and other unintended surfaces before it dries — the stuff is great until it's stuck to your fingers. Installing outlet plugs and foam pads that go behind outlet and switch covers is almost always worth the trouble, especially in cold climates.

And, yes, do install weatherstripping. But shop carefully. "A lot of weatherstripping products just flat don't work," says John Krieger of NATAS. As an example, he cites as "useless" the vinyl-bulb strips fitted into long pieces of extruded aluminum. It's nearly impossible to make them stay in place, even if they were installed right in the first place. Sturdy bulbs and spring-flaps made of siliconized rubber, or vinyl flaps installed on the door jamb work better. Roger Harris suggests avoiding foam-rubber products, which tend to disintegrate quickly. Rope-caulk and shrink wrap are good temporary draft stoppers for renters. For homeowners, tight-fitting storm windows, silicone caulk, and good, permanent weatherstripping are worth the extra cost and effort in the long run.



Insulation

Next, turn your attention to insulation. How much do you have? In moderate climates, the absolute minimum recommended levels are R-38 for attic accesses and ceilings, R-13 for 2x4 stud walls, R-19 around rim joists (which sit on the sill plate), R-5 on foundation walls, and R-19 above crawlspaces and unheated basements. A better goal in these temperate areas

would be R-50 in the ceiling, R-32 in walls, R-24 in floors above unheated areas, and R-16 in foundations and above-grade walls. In areas with extreme winters, insulating to R-40

OVER →

SWEDISH-STYLE EFFICIENCY

Buying a new house in the U.S. is, increasingly, the prerogative of the wealthy. At a time when fewer and fewer young American families can afford to own a house, homelessness is rife, and "affordable" housing (where it can be found) is too often synonymous with cheap, tawdry construction, the example of Swedish housing is instructive.

Sweden has developed one of the world's most comprehensive systems for ensuring affordable, well built housing for its citizens. One aspect of the Swedes' emphasis on quality is energy efficiency: The typical Swedish house uses half to two-thirds as much energy as do houses in the rest of Europe and in North America, even though Swedes keep their houses warmer in the winters than people in other countries do.

How do they manage? They pay a price in higher income taxes, but some of that is offset by lower home prices and reduced energy costs. Some observers complain that there is an institutionalized sameness to Swedish houses, but the lack of variety in a Swedish neighborhood could hardly be greater than it is in many American tract-house developments. Anything but poorly designed, the average new Swedish house is a marvel of engineering and craftsmanship.

Prompted by a severe housing shortage in the 1940s, Sweden implemented policies that have made its housing industry the envy of the world. The government's Ministry of Housing worked with builders and manufacturers to produce a system of house-building that is efficient in its use of

materials and labor, as well as in the energy needs of the finished product. The industry is "vertically integrated," meaning that house-building companies do everything from cut the trees and mill the lumber to fabricate walls and other components in state-of-the-art factories, and then deliver and assemble the complete house on-site.

The result is not what Americans tend to think of as "factory-built housing," which has a reputation in this country for mediocre quality. The "factory-crafted" houses of Sweden are more like Volvos than mobile homes.

The most heavily insulated Swedish houses feature wall R-values of 40 and roof R-values of 60 or more. Instead of using framing studs made of solid wood, which conduct heat through the walls, they use engineered "I-beam" studs made of two strips of lumber (like a 2x4 ripped down the middle) connected by a strip of Masonite. Great importance is placed on installing thick, continuous vapor barriers near interior wall surfaces, and wind barriers near exterior wall surfaces. Windows are triple-glazed and coated with a low-emissivity film.

The finished houses are so tight and well insulated that they are heated mostly by lights, human bodies, and incidental solar energy. Small, efficient furnaces, electric heaters, or heat pumps make up the difference. Not only does the low energy requirement of the average house save its owners in energy costs, but it has also helped the country toward its goal of having the option to eliminate nuclear

power in the next century.

Some Swedish-style efficiency has made its way to the U.S. One large Swedish house-building company teamed up with an American architect to create a development in Sharon, Massachusetts, a suburb of Boston. The houses in the development, designed to appeal to high-end American homebuyers, were fabricated in a Swedish factory, shipped across the ocean, and assembled in Massachusetts. In Maine, the Passamaquoddy Indians have entered into a joint partnership with a home-building company based in Finland (where energy and quality standards for houses are similar to Sweden's). Using Scandinavian factory technology, the Passamaquoddies are producing panels for multi-family dwellings that can be shipped and assembled anywhere in the country.

Perhaps enough of this exemplary housing technology will filter into the U.S. so that American politicians will be forced to take a careful look. Then, perhaps, they'll see the wisdom of launching a concerted national effort to improve the quality, affordability, and energy efficiency of this country's housing. Surely it's a challenge as worthy as that of putting a man on the moon — and the benefits will accrue not in the heavens, but right here on Earth.

— Craig Canine

For more information about Swedish housing, write to: Orjan Isaacson, SWEBCO, 150 N. Michigan Ave., Chicago, IL 60601, (312) 781-6215.

in walls and R-60 in ceilings is not excessive.

Fiberglass batts are the most popular form of insulation for do-it-yourselfers, but they, too, are on Roger Harris' "overrated" list. "Unless you fill all the nooks and crannies in the wall cavity with it, and then fluff it out perfectly, you're not getting the rated R-value with batts," he says. He generally recommends class-I cellulose insulation (for walls) or blown-in fiberglass (for ceilings). Unless you take pains to rent good equipment and do a careful, thorough job, installing insulation yourself may save less money in the long run than hiring a top-notch insulation contractor.

Installed prices for blown-in cellulose range from 80 cents to \$1.25 per square foot of 2x4-framed wall area; blown-in fiberglass (manufactured by Owens-Corning, Manville, and CertainTeed) costs from 50 to 70 cents per square foot of attic area for a 12-inch-thick layer. The payback period for an insulation retrofit depends on your climate, the type of heating system you have, and the amount of insulation you started with, but 2- to 3-year paybacks aren't uncommon in older houses that started out under-insulated.

How Tight is Too Tight?

Battening down the air leaks and fluffing up the insulation levels in your house will no doubt save you energy, but they may also have an undesirable side-effect: holding warm, moist, stale air indoors. This can wreak all kinds of havoc, from causing mold, mildew, and rot to set in on walls and ceilings, to creating a foul-smelling indoor environment that is as unhealthy as it is unpleasant. If residential energy-experts have learned one thing over the past two decades of experience and research, it is that the air-tightness of a house should not be increased without simultaneously improving its ventilation.

Increased tightness and more ventilation might sound like contradictory goals — after all, what is a draft but a form of ventilation? But the true goal of tightening a house is to remove all unintentional, random sources of air leakage and replace them with controlled air exchange. That's where air-to-air heat exchangers are indispensable: As they exhaust warm, stale air, they recover much of its heat and transfer that heat to a controlled supply of fresh, incoming air.

Like furnaces, air-to-air heat exchangers come in many types, sizes, capacities, and prices. A local HVAC (heating, ventilation, and air conditioning) contractor will no doubt have a favorite to recommend. Nutone, Standex, and Enermatrix are a few of the several respected brand names. Prices range from about \$800 for a small unit suitable for ventilating a small house or a few rooms, up to a few thousand dollars for large, whole-house models.

• FURNACE FIXES



Reducing your house's heating requirements is an important stride towards efficiency, but don't stop at that. Save some time and money for supply-side improvements. Experts like Roger Harris say homeowners tend to underrate the benefits of boosting the efficiency of their furnaces and water heaters.

If the cash for a new furnace or boiler isn't on hand, make the most of the heating system you already have. You can improve your home-heating efficiency by a third by installing a flue damper, turning off pilot lights (and the incoming fuel supply) during the off-season, taping and insulating ducts, having your furnace cleaned and fine-tuned annually, and using an automatic setback thermostat. Other furnace fixes worthy of consideration are downsizing the fuel orifice, replacing the burners with more efficient models, and replacing the pilot light with an electronic-ignition unit.

If your heating system is 18 or more years old, it has reached the end of its life-expectancy. Replacing it with a new, more efficient model is probably a good idea. Not only is an efficient furnace or boiler likely to be a cost-effective investment, but replacing it calmly during the off-season will prevent the freezing house, burst pipes, and related misery of a mid-winter breakdown.

The most efficient new furnaces use half as much energy as average older models. New furnaces are rated by their Annual Fuel Utilization Efficiency (AFUE), a standard measurement of overall seasonal performance. New gas units offer the greatest efficiency gains: Older models with pilot lights have an average AFUE of 62 percent, while the most efficient unit on the market (a Carrier 40,000-Btu/hour furnace) has an AFUE rating of 97.3 percent. Furnaces with AFUE ratings in the high 80s and up are called "condensing" furnaces. Their heat-exchangers wring so much heat from combustion gases that a normal chimney flue isn't needed; they can be vented with a small PVC pipe. However, the condensate (which is quite acidic) must be properly drained. These units cost a good deal more than non-condensing furnaces, and are most economical in areas with long, cold winters.

Those who live in moderate to mild climates will find non-condensing furnaces to be the best buys — but beware of dinosaurs. It's still possible to find a new gas furnace with an abysmal, 58-percent AFUE rating. These furnaces operate on the old-fashioned "atmospheric draft" principle, which means that they work like any open fire, using whatever surrounding air is available for combustion. Far more efficient are furnaces with an induced or forced draft, which means that a fan delivers a controlled quantity of air to the burner for optimum combustion — something like a motorized bellows. These furnaces have AFUE ratings of at least 80 percent, whether for gas- or oil-fired units. If you've done a good job of insulating and draftproofing your house, you should be able to replace your furnace or boiler with a less powerful unit, saving even more in lifetime energy costs (because smaller furnaces and boilers tend to be more efficient than larger ones).

• AIR CONDITIONERS



In areas with long, hot summers, air conditioning is the biggest energy user. Houses in the South tend to be even leakier than their northern counterparts. The uncontrolled ventilation was, perhaps, welcome before air conditioners became stan-

dard home appliances. With air conditioning, however, a leaky house in a hot climate is just as energy-inefficient as a sieve in a northern winter. Especially in hot areas where humidity is also high, an air conditioner must remove the excess moisture from the air in addition to removing its excess heat, which multiplies the amount of energy the air conditioner uses. Plugging air leaks and adding insulation keeps hot, humid air out of the house, increasing air-conditioning efficiency dramatically.

Air conditioners have become much more efficient over the past decade, and the 1987 national appliance standards, which take effect in 1990 for room air conditioners and in 1992

for central air conditioners, promise to bring average efficiencies higher yet. Room air conditioners are rated by their Energy Efficiency Ratio (EER), the ratio of their cooling output divided by their energy consumption. A unit with an EER of at least 8.5 is efficient (the average new unit has an EER of about 8); any EER over 9.5 is highly efficient. Central air conditioners are rated by their Seasonal Energy Efficiency Ratio (SEER). According to the American Council for an Energy Efficient Economy, the average new central air conditioner sold in 1987 had a SEER of around 9. The efficiency standards that will take effect in 1992 will require new units to have a minimum SEER of 10. The most efficient models

PLANT A TREE, COOL THE GLOBE

Electric utilities generate 28 percent of the United States' annual carbon dioxide (CO_2) emissions, and electricity generation in the U.S. accounts for about 7.5 percent of total worldwide CO_2 emissions. That's a big chunk of the world's global-warming problem. But if every utility company followed the example of Applied Energy Services of Arlington, Virginia, the utility industry's role in global warming would shrink dramatically.

Applied Energy Services set a precedent in 1988 by announcing that it will plant enough trees in Guatemala to absorb the CO_2 that its new coal-fired power plant in Connecticut will emit. "Given the scientific consensus on the seriousness of the problem, we decided that it was time to stop talking and act," said Roger Sant, CEO of the small utility company.

Over its planned 40-year lifetime, Applied Energy's new 180-megawatt Connecticut power plant will spew about 15 million tons of CO_2 into the atmosphere. To offset this pollution, the company is putting up \$2 million toward a tree-planting effort that will also include a \$1.2 million contribution from the Guatemalan government, \$3.6 million from the U.S. Agency for International Development, \$7.5 million from the Peace Corps, and \$2 million in cash or services from CARE, the international relief and development organization, which will also manage the project. The project's sponsors hope that about 40,000 Guatemalan farmers will help

plant 385 square miles (about 250,000 acres) of trees—more than enough to offset the CO_2 emissions of Applied Energy's new plant.

Laudable as the project is, however, it's like a cup of water in a



drought. Worldwide, an estimated 6 billion tons of CO_2 from fossil-fuel combustion are emitted every year. At the same time, 26 million acres of trees, which would otherwise absorb some of that CO_2 , are being cut down annually. To compensate for the combined effects of fossil-fuel burning and deforestation, it would be necessary to plant 3 billion acres of trees—an area larger than the entire United States.

Still, every tree helps. Research at Lawrence Berkeley Laboratory (LBL) in Berkeley, California, shows that planting trees helps reduce global warming in more ways than one. Not only

do trees take CO_2 out of the atmosphere, but they also provide shade and, through "transpiration," they cool the air around them like natural air conditioners. Planting trees in urban areas, together with using light-colored surfaces for roofs and pavement, is the cheapest way to save kilowatts of air-conditioning power. "Put very simply, the recipe is this," says Art Rosenfeld, director of the Building Science Center at LBL. "Pay \$15 to \$75 to plant and water trees around a house, wait 10 years for the trees to grow, and then save about 1 or 2 kilowatt hours of peak power, and about 750 to 2,000 kilowatt hours per year in air-conditioning energy per house—worth \$50 to \$100 each year."

Put another way, three mature trees planted near your house can save you, in annual air-conditioning costs, about as much as it costs you to run your refrigerator for a year. If you don't use an air conditioner much, the trees will still contribute to your summer comfort and remove up to 50 pounds of CO_2 from the air each year.

The American Forestry Association has the idea. Last year, it launched a global reforestation program with the slogan, "Plant a tree, cool the globe." AFA calls its project "Global Releaf." For information on how you can participate, write: The American Forestry Association, P.O. Box 2000, Washington, DC 20013.

— Craig Canine

available have SEERS of 12.8 to 15, depending on their capacity (large-capacity units tend to be more efficient).

• WATER HEATERS



Regardless of one's climate or location, replacing the water heater is an often overlooked opportunity to improve household energy efficiency. "All water heaters are not alike," Roger Harris says, "though many homeowners often assume they are." Like furnaces and boilers, water heaters are available in a wide range of efficiency ratings, from poor to quite respectable. They're rated by their

Energy Factor, an overall indicator of efficiency based on the use of 64 gallons of hot water per day. The most efficient water heaters must be used in conjunction with a compatible, highly efficient gas furnace (such as the Amana EGHW series).

The water heaters with the highest EF ratings are electric models. Their 95- to 97-percent efficiency ratings look impressive — until you consider that electricity is a highly refined form of energy that requires a great deal of energy to create. Only one-third of the energy in the coal burned at a coal-fired generating plant is translated into electrical energy; the other two-thirds goes up the smokestack (which is one reason why electricity is "the clean fuel" only if you consider the point where it's used, not the byproducts of its generation). So an electric water heater with an EF of 97 is really only about 33-percent energy-efficient if you consider all the energy it consumes. (The same is true for electric-resistance space heating.)

This consideration is especially important from the global-warming perspective. In general, the high "end use" efficiencies and relatively low initial costs of electric heating units tend to mask the high environmental costs of generating electricity, whether by means of nuclear or fossil-fuel energy. Electricity is also quite expensive in many parts of the country, and growing more so. In purely pragmatic terms, over a 13-year lifetime, an electric water heater with a purchase price of \$400 will cost more than twice as much as an identically sized gas water heater with the same \$400 purchase price. And in global-warming terms, the electric water heater will be responsible for the release of about 78 tons of CO₂ into the atmosphere over its lifetime, while the gas water heater will release about 29 tons of CO₂. Either way, gas wins.

You'll compound the efficiency of a new, high-EF water heater by insulating hot-water pipes and reducing the amount of hot water your family uses. One way to conserve hot water is by installing a low-flow showerhead. Early models gave hot-water conservation a bad name. They saved water, sure enough, but using them was like standing *au naturel* on the Maid of the Mist. Newer models, such as the Spa 2000, have flow-rates about half as great as non-conserving showerheads (around 2.5 gallons per minute instead of 5 gpm), but they still provide an invigorating shower. Flow-restricting aerators placed on kitchen and bathroom sinks will result in even greater savings on hot-water bills (and on the use of

fresh water, an increasingly scarce resource), without reducing comfort. The best low-flow showerheads cost no more than \$20, while faucet aerators cost less than \$10. Paybacks for these products depend on household hot-water use, but are frequently on the order of a year or less. (See "Keepers," page 56, September/October issue.)

• REFRIGERATORS



Your refrigerator should be the next item on your home-energy audit. Advances in efficiency here, too, have been great over the past decade, and national appliance-efficiency standards will mandate further improvements in the next few years. The typical refrigerator bought in 1973 consumes about 2,000 kWh of electricity per year, which takes about a refrigerator-full of coal to

generate. At 6.75 cents a kWh, the old fridge costs about \$130 per year to operate. A typical new model, by comparison, costs less than \$75 per year to run, whereas the annual operating cost of a highly efficient new model is more like \$50 to \$60. Models with the refrigerator and freezer positioned side-by-side are less efficient than those with the freezer mounted on top.

You can keep any refrigerator running more efficiently by keeping the coils on the back free of dust and fuzzballs, and by providing plenty of ventilation around the refrigerator to prevent heat build-up. Also, use a thermometer to check the temperature. Optimum temperatures are 38 to 42 degrees F. in the refrigerator compartment and 0 to 5 degrees F. in the freezer. If it's 10 degrees colder than that, your refrigerator is using 25 percent more energy than it has to. Contrary to what your mother told you, however, standing in front of an open refrigerator does not add hugely to the family's energy bills. Most of the cold air falls out immediately after opening the door, so a visit lasting 10 seconds doesn't use significantly less energy than one lasting half a minute.

Selling your old refrigerator before buying a new one may make the purchase more economical, but it won't help keep the world cool. "If you are conscious about warming the planet," Harris says, "you should take the door off your old refrigerator and make sure it goes to the dump." In the best of all possible worlds, the CFCs (chlorofluorocarbons) used to cool your old fridge would be removed first and recycled.*

When you're looking for a new appliance, be sure to take advantage of the information collected in "The Most Energy-Efficient Appliances," a booklet published by the American Council for an Energy-Efficient Economy (ACEEE). The annually updated booklet contains the latest data on the efficiency of individual makes and models of furnaces, boilers, heat pumps, water heaters, air conditioners, dishwashers, clothes washers, and refrigerators. The booklet also contains

*The technology already exists to recycle CFCs in cars. If you know of anyone doing this on a commercial scale for refrigerators, we'd like to know about it! — the editors.

a worksheet for computing and comparing lifecycle costs of various appliances. Another booklet, "Saving Energy and Money with Home Appliances," is a helpful guide to choosing, installing, and maintaining 10 key appliances. (See "For More Information" below for ordering these and other publications from ACEEE.)

LIGHTING



replacing light bulbs doesn't involve labor costs as it does for business.

Still, the new compact fluorescent bulbs, which screw into ordinary light-bulb sockets, are a good investment for any lights that are on for four hours or more per day. You can replace a 75-watt incandescent bulb with an 18-watt compact fluorescent. It provides the same amount and quality of illumination, uses a quarter of the electricity, and lasts 13 times

The biggest advances in energy-saving technology over the last several years have taken place in the area of lighting. For businesses and industries, investing in lighting efficiency is the next best thing to striking gold. The potential economic benefits for homeowners are not as great, since most household lights are on for only a few hours per day, and

longer. The new bulb may cost \$20 or more, but it will probably pay for itself twice over its 10,000-hour lifetime. And, if your electricity comes from a coal-fired power plant, the new light bulb will slow global warming by avoiding the emission of a ton of CO₂.

Osram, Philips, and Matsushita are three of the most reputable manufacturers of compact fluorescents. Beware of off-brands that don't print the bulb's lumen rating and expected lifetime plainly on the box. These off-brands cost less than the reputable brands, but they often wear out after no more than 100 hours.

Unfortunately, good compact fluorescents are hard for homeowners to come by. A rare home center or lighting specialty store may stock them, but the best sources for most homeowners are mail-order firms. See "For More Information" for the addresses of two such sources.

Improving the energy efficiency of your home is a no-lose proposition. In the short run, you'll reduce your energy bills, improve the comfort of your home, and probably increase its market value. By spending less on energy, you'll free up income that can be spent or invested more constructively. (If the whole nation followed your lead, the U.S. would vastly improve its economic competitiveness.) And in the long run, cutting your household energy consumption will help curtail the greenhouse-gas emissions that threaten to change the world as we know it. Alan Durning, a researcher for the Worldwatch Institute, a Washington, D.C.-based environmental think tank, summed up the situation well when he wrote, "Truly, self-interest and altruism converge on the home-energy front: Improving our individual homes protects our planetary home."



FOR MORE INFORMATION

The American Council for an Energy-Efficient Economy (ACEEE)

1001 Connecticut Avenue, NW
Suite 535

Washington, DC 20036

Copies of "The Most Energy-Efficient Appliances" (1989 edition) and "Saving Energy and Money with Home Appliances" are available for \$2 each. Ask for a complete ACEEE publications list.

A Brighter Way

5214 Burleson Road, #317
Austin, TX 78744
Free brochure

Massachusetts Audubon Society

Educational Resources Department
South Great Road
Lincoln, MA 01733
(617) 259-9500, ext. 7250

The Massachusetts Audubon Society publishes "How to Weatherize Your Home"

or Apartment," "All About Insulation," "Financing Home Energy Improvements," and five other well researched energy booklets. Copies cost \$3.50 each (postpaid) or \$20.50 for the entire set of eight booklets. Send a check with your order, or ask for a free catalog of the Society's publications.

Rising Sun Enterprises, Inc.

Box 586
Old Snowmass, CO 81654
(303) 927-8051

Rising Sun is a source of compact fluorescent lights, low-flow showerheads (including the Spa 2000), and faucet aerators. The "Rising Sun Sampler" is a packet of information that introduces compact-fluorescent technology and describes the company's line of energy-saving products. Samplers cost \$3 ppd.

National Appropriate Technology Assistance Service (NATAS)

Call 1-800-428-2525 (in Montana,
1-800-428-1718) or write:
NATAS

U.S. Department of Energy
P.O. Box 2525
Butte, MT 59702-2525

This national service can provide information and tips on conserving energy at home.

Cut Your Electric Bills in Half by Ralph J. Herbert. Rodale Press, 1986. \$9.95, paperback. Some of the information in this book is outdated, but it's still a good guide to reducing overall home energy use, not just electricity. The book includes names and addresses of manufacturers of efficient appliances, in addition to data and worksheets to help you find the best ways to cut down on your household energy consumption — and your share of global warming.

CARS

THE ENVIRONMENTALISTS' HIGHLIGHT OF THE YEAR
FOR MAKING ALLS THE RIGHT NOISE,
BUT MANUFACTURERS HATE THEM.

by Janet Marinelli

S

hhh! Please don't let this get around. Environmental writers are supposed to loathe cars, consider them mankind's greatest single crime against the planet. *I adore them.*

My fascination with the automobile began with my first car — a used, 1968, British-Racing-Green Austin-Healey Sprite. I spent my college years zooming along country roads in New York State, top down, hair flying in the wind.

I'm not alone. Automobile scholars continue to be astounded by America's seemingly insatiable appetite for cars. Predicting when the American public will reach the "saturation point" in auto ownership has become a kind of trivial pursuit. Initial assumptions that "saturation" would occur at one vehicle per household were proven wrong in the 1930s. By the mid-1960s, we'd disproven the notion that car ownership would peak at one per worker. By 1983, we'd left in the dust expectations that we Americans would never average more than one vehicle for every driver.

We've all heard the litany of indictments against the automobile. Cars have overrun our cities. Ribbons of highway slice up urban neighborhoods. Car crashes kill tens of thousands of Americans each year. Car exhaust makes the air unfit to breathe, and becomes the acid rain that's killing lakes and streams. But the real clunker is not widely known: Car exhaust is one of this country's largest single sources of CO₂, the heat-trapping gas scientists be-

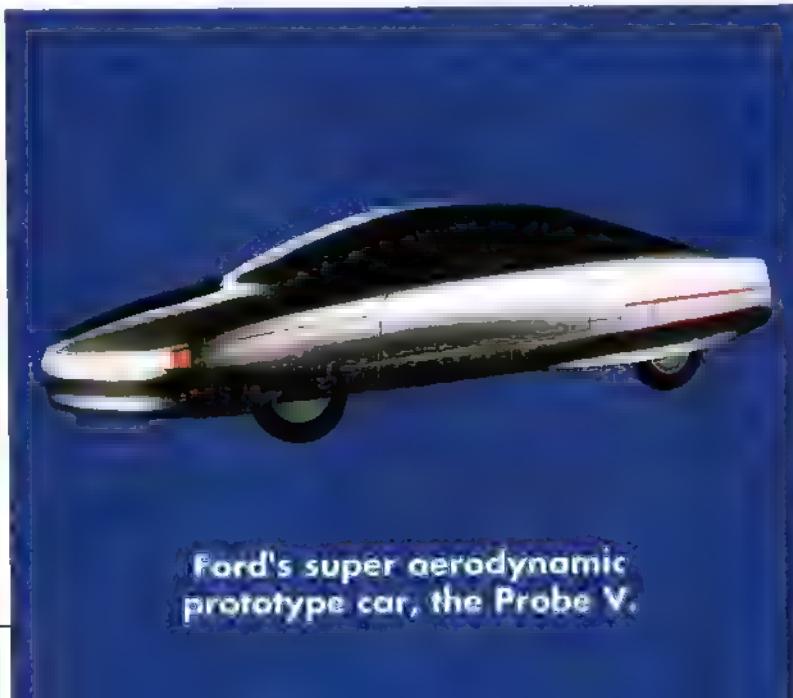
lieve is the major cause of the greenhouse effect that threatens to raise global temperatures up to nine degrees in the next century. According to a study by the Environmental Protection Agency (EPA), CO₂ emissions from cars will have to be cut roughly in half by the year 2000 — ten short years from now — if warming is to be limited to 4 degrees and reversed by the middle of the next century.

So I should be telling you to bike to work. Take the bus. Give up your car(s) for Lent. But as one skeptic recently observed, "Of course we all know that if EVERYBODY ELSE would get off the road, car-caused social problems would vanish." Let's be real. The only short-term solution is for auto makers to design a car we can live with.

* CARS AND THE GREENHOUSE EFFECT

The average American car pumps its own weight of CO₂ into the atmosphere each year. Multiply that by the more than 139.5 million cars on the road in this country (183 million motor vehicles total, 515 million worldwide) and you begin to understand the dimensions of the problem.

After almost two decades of tinkering, automotive engineers have managed to remove 96 percent of the carbon monoxide, hydrocarbons, nitrogen oxides, and other pollutants spewed by cars. Unfortunately, catalytic converters and other high-tech pollution



Ford's super aerodynamic prototype car, the Probe V.

controls do absolutely nothing to get rid of CO₂. As carbon dioxide poses no threat to human health, until the recent concern about global warming, nobody dreamed it would need to be regulated. In fact, today's clean-burning engines produce no less carbon dioxide than a Ford Model T.

Carbon dioxide emissions are directly related to the amount of fuel burned in a car's combustion engine. Doubling fuel efficiency roughly halves

CO₂ emissions. The average car on the road today gets about 18 miles per gallon (mpg). The Energy Conservation Coalition, a Washington, D.C.-based coalition of environmentalists and other advocates of energy efficiency, calculates that over its lifetime, this average car emits 57.75 tons of CO₂. A car that gets 27.5 mpg (the U.S. standard for 1990 model cars) can be expected to spew substantially less — about 37.71 tons. In other words, if we all shifted to more fuel-efficient cars, we'd sharply reduce CO₂ emissions — and with them our contribution to global warming.

If present trends continue, however, car CO₂ emissions will only get worse. Consider the following statistics:

- According to J.D. Power and Associates, who conduct annual surveys on what car buyers look for, in 1980, about 33 percent of those surveyed listed fuel economy as the most important factor they'd consider when selecting their next car. By 1984, the figure had fallen to 6 percent.

- Fuel economy is not hot in car-marketing jargon at the moment, but old buzzwords like "power" and "performance" (which mean less fuel efficiency) have made a comeback. According to the Congressional Office of Technology Assessment (OTA), the average 0 to 60 mph acceleration time for new cars has decreased every year since 1982. OTA points to two studies which claim that the reduction in average acceleration time from 14.4 seconds in 1982 to 12.9 seconds in 1987 cut fuel economy from 3 to 5 percent.

- Cheap gas has also rekindled the American love for the old-fashioned, full-sized family car. More consumers are buying large, heavy, rear-wheel drive models instead of newer, more fuel-efficient designs. According to the Motor Vehicle Manufacturers Association (MVMA), subcompacts accounted for about 15 percent of sales in 1980. By 1988, that was down to 9 percent. In 1980, mid-sized cars took 21 percent of the market. That grew to more than 28 percent last year.

- We're insisting on four-wheel drive, power seats, power sunroofs, power locks, power windows, and other gas-guzzling options in record numbers. (Air conditioners and power steering also guzzle gas, but they're nearly standard, being in more than 80 percent of new cars.)

The result: The gas mileage of new cars improved only 2.1 percent in 1986 and 0 percent in 1987, and by 1988 was actually decreasing, according to calculations by the Energy



**Honda's sporty CRX
is very fuel efficient**

Conservation Coalition

To make matters worse, sales of gas-guzzling light trucks (small pickups, vans, and minivans) and so-called special purpose vehicles (Blazers, Broncos, and the like) are booming. The MVMA says factory sales of light trucks set a record of 2.7 million in 1988. Sales of light trucks have gone up every year since 1980, when about half a million were sold.

This skid in fuel-efficiency improvements is made all the more disturbing by the fact that we're driving our cars more than ever. According to MVMA's *Motor Vehicle Facts & Figures '89*, in 1987, the average car travelled 9,883 miles (up from 9,608 the year before). All told, motorists drove almost 1.4 trillion miles (up from less than a trillion in 1970 and a "mere" 360 billion in 1950).

And there are more vehicles on the road than ever. The 183 million motor vehicles registered in the United States last year represented an increase of nearly 4.4 million in just one year.

• FUEL ECONOMY GOT A BAD NAME

Between 1975 and 1985, auto makers pulled off a remarkable feat. They almost doubled the number of miles that cars and light trucks could travel on a gallon of gas. Faced with two major oil crises and hour-long gas lines, we consumers were clamoring for small cars — and loving them.

Most of the early gains in fuel efficiency were accomplished the quick and easy way: by making cars lighter. A vehicle's weight contributes significantly to its fuel economy (or lack thereof). A 10 percent reduction in weight improves city fuel economy about 7 or 8 percent and highway fuel economy about 4 or 5 percent. During the past decade, the average weight of a new American car has dropped from more than 4,000 pounds to just over 3,000 pounds. Most of this decrease was the result of simply making cars smaller.

Not surprisingly, since there was less sheer mass to protect occupants in the event of a crash, and since automakers had not compensated by using stronger materials and sturdier designs, the first generation of fuel-efficient cars wasn't very crashworthy. Fuel-efficient (that is, small, light) cars got a bad name. When the oil glut of the mid 1980s sent gas prices plummeting, car buyers abandoned them in droves.

In the past ten years, however, automotive engineers have learned quite a lot about how to achieve fuel efficiency without sacrificing safety. It is possible to design a safe and fuel-efficient car. As an example, Deborah Lynn Bleviss, Executive Director of the International Institute for Energy Conservation in Washington, D.C., cites crash tests conducted on 1985 models by the U.S. National Highway Traffic Safety Administration: General Motor's Astro minivan, which

MOBILE AIR CONDITIONERS

Car air conditioners are the largest single source of chlorofluorocarbons (CFCs) in the atmosphere. CFC-12 (Freon), the coolant in car air conditioners, has 20,000 times carbon dioxide's capacity to trap heat, and is increasing in the atmosphere at 5 percent a year. There are about 60 million "mobile air conditioning units," as they're known in the trade, in the U.S. alone. Large amounts of CFC-12 leak into the air during servicing and also during regular operation of auto air conditioners.

Unlike most chemicals, CFCs don't break down in the troposphere, the layer of air closest to the Earth. They waft slowly upward, reaching the upper atmosphere in about six or eight years. Scientists believe that CFCs, which can survive in the upper atmosphere for a century, contribute not only to global warming, but also to the depletion of ozone, which protects us from the sun's most harmful rays.

Auto makers will be switching from CFC-12 to less harmful substitutes during the next decade. In the meantime, we drivers can minimize CFC emissions from

our cars. We can have the CFC-containing coolant removed from our air conditioners and recycled, and roll down the windows for a few years. We can buy cars without air conditioners, saving several hundred dollars from the sticker price — and increasing fuel efficiency.

If the heat is unbearable in your area, you can make sure your car air conditioner is properly serviced. During servicing, it's now standard practice to drain the coolant and let it evaporate. The auto industry is setting up a voluntary recycling system for CFC-12; if the industry isn't recycling enough by 1992, the Environmental Protection Agency will make the practice mandatory. Recycling machines, known as "vampire machines," pump out the coolant, purify it, then reinject it into the car's air conditioning system. Since vampire machines cost several thousand dollars, you're most likely to find them at dealerships and busy service stations.

Don't recharge your air conditioner using the do-it-yourself cans of coolant available at auto parts stores. These cans allow car air conditioners to be refilled cheaply enough, but without repairing the leak. Another refill will soon be required.

— Janet Marinelli

weighed in at a bloated 4,100 pounds, scored worst in safety. In 1989 tests by *Consumer Reports*, the Astro minivan continued to rate poorly. The compact Ford Escort (see "Gas Sippers," page 35) was one of the safest cars tested. Many subcompact cars also scored well in the magazine's crash tests.

In other words, safety is not just a function of size or weight. By using new materials and body designs that enhance structural integrity, car companies can now make small cars that are safer than larger old models. In the years ahead, safety is bound to increase even more, as the plastics and plastic composites increasingly used in body panels and chassis often can absorb more energy (impact) than the steel they replace.

American drivers haven't quite forgotten, too, that the acceleration of early fuel-efficient cars left a lot to be desired. Remember merging onto a crowded highway, flooring the gas, and

holding your breath, hoping no one would hit you in the rear? Poor pep was another function of poor design. Another way Detroit boosted fuel economy in the '70s was to simply throw a smaller engine in a big car. That did improve fuel efficiency, but it sure compromised power and acceleration. Today, engineers have a much better idea of how to compensate for using a less powerful, more fuel-efficient, engine.

Another familiar complaint about fuel economy is that it can be achieved only at the expense of a car's roominess and comfort. But fuel-efficiency experts point to prototype vehicles that prove this ain't necessarily so. For example, a Toyota prototype, the AXV, was specifically designed for maximum roominess. It holds five passengers comfortably—not six like the old-fashioned family car, true. But surveys show that 87 percent of the car trips in this country are taken with two people

The Geo Metro is the highest-mileage car sold in America

or one. Do we really need six-passenger behemoths?

• HIGH-MILEAGE CARS

According to the EPA, new cars will have to average 50 mpg by the year 2000 if global warming is to be blunted — almost double the 26.5 mpg of today's average new car. Sounds impossible.

But when you think about it, if we'd only get over our addiction to big cars, enormous increases in fuel efficiency would be possible right now. A couple of cars that get 50 mpg or more are already available across the country.

The Geo Metro is the most fuel-efficient car sold in America today. With a 5-speed manual transmission and a 3-cylinder, 1.0-liter engine, the Metro gets an estimated 53 mpg in the city, 58 mpg on the highway.

The Honda Civic CRX HF, a sporty two-passenger car with a 5-speed manual transmission and 1.5-liter, 4-cylinder engine, gets 50 mpg in city driving and 56 mpg on the highway. The CRX has twice been named import car of the year by *Motor Trend* magazine.

If you're shopping for a car, there's certainly no excuse for buying one that doesn't get mileage at least in the 30s. See "Gas Sippers" on page 35.

If you must have a larger car, keep in mind that the 1989 mid-sized cars rated most fuel efficient by the EPA are the Dodge Aries and Plymouth Reliant. With automatic transmissions, these cars rated 24 mpg city and 30 mpg highway; 25 mpg city and 34 mpg highway with manual transmissions. The best large car was the Eagle Premier, with an automatic transmission and ratings of 22 mpg city and 31 mpg highway.

If you're in the market for a new car, be sure to consult the *EPA Gas Mileage Guide*. Car dealers are supposed to make it available to buyers in their showrooms.

A variety of innovative fuel-efficiency technologies are already built into a few widely available models — proof positive that we're unlikely to reach the limits of fuel-efficiency technology anytime soon. In the next few years, these technologies could be much more widely used.

Testifying before Congress in April, Steven E. Plotkin of the Office of Technology Assessment listed existing technologies that could improve average new-car mileage by 5 or 6 mpg — up to 33 mpg by 1995 — without causing undue disruptions in the auto industry. These include front-wheel drive, 4-cylinder/4-valve engines (most car engines have two valves per cylinder), 4-speed automatic transmissions, tires with reduced rolling resistance, and improved aerodynamics (measured by drag coefficient, or C_D — for you car buffs, Steven Plotkin figures C_D can be reduced from 0.37 to 0.32). Among the engine improvements he considers most feasible: overhead cams, low-friction rings and pistons, and throttle body and multipoint fuel injection. Steven Plotkin



Renault's VESTA2 prototype gets 107 mpg on highways.

calculates that these technologies would add about \$250 to the cost of a car but would pay for themselves in lower gas bills in four years.

Steven Plotkin's analysis is conservative. Other innovative technologies already in use could boost fuel-efficiency even higher.

The Honda Civic CRX is the leading example of the use of plastics to reduce weight and improve fuel economy. Honda

developed a new plastic, called Honda polymer alloy (HPA) for use on the CRX's front mask, front fenders, lower door panels, and side sill garnish. HPA has high-impact strength at low temperatures, and it can be recycled. Another plastic, Honda polymer blend (HPB), is used for the car's front and rear bumpers. Altogether, plastic is used for more than 40 percent of the CRX's outer panel area. General Motors has also pioneered in the use of plastics, though not specifically for the purpose of a more fuel-efficient car. The Chevrolet Corvette has had a plastic body for years. In August, the auto maker unveiled the Chevrolet Lumina van, with a body made almost entirely of plastic.

Other lightweight materials are also being used to improve fuel economy. One of the reasons the Geo Metro gets such great gas mileage is that it has a lightweight aluminum engine. So does the CRX.

The Subaru Justy is the first modern production car to have a continuously variable transmission, or CVT. Most cars sold in this country still have inefficient 3-speed transmissions; roughly a third have more efficient four speeds. (Increasing the number of gears enables a motor to run more efficiently.) CVTs are a major improvement over even 4-speed transmissions because they in effect give a car an unlimited number of gears. According to Deborah Lynn Bleviss of the International Institute for Energy Conservation, on a Japanese city test, the Justy's continuously variable transmission improved fuel economy 20 percent over a 3-speed automatic and 10 percent over a 5-speed manual transmission.

Two other innovative technologies already in use are lean-burn and variable-displacement engines. In variable displacement engines, cylinders can be deactivated as less power is required. Mitsubishi has had one in its Mirage since 1982. The Mirage's engine has four cylinders, two of which are deactivated in third and fourth gears when power demands are relatively low. The result, according to Deborah Lynn Bleviss, is a fuel-economy improvement of 20 percent in Japanese and 11 percent in U.S. city-driving tests. Lean-burn engines, on the other hand, improve fuel efficiency by reducing the level of gasoline in the standard air-fuel ratio needed for efficient engine combustion. Honda already has a moderate lean-burn engine in its CRX, with a resulting 10 percent improvement in miles per gallon. Toyota introduced an ultra-lean-burn engine in the Carina (not sold in this country)

continued on page 34

Disposable Decades

Gulf
Crest

In 1950 and '51,
you probably didn't
forget our became a leader
in the passenger car business.

Today you're still doing it.
In fact, we've added
new passenger passenger
cars to our fleet.

Our new cars are
the result of our
experience in
making passenger cars
since 1950.

Our new cars are
the result of our
experience in
making passenger cars
since 1950.



continued from page 31

in 1984, adding an estimated 16 to 20 percent to the car's mileage. (Large cars with ultra-lean-burn engines may have trouble meeting U.S. standards for nitrogen oxide emissions. Engineers think they've got the problem licked. Stay tuned.)

Scores of other fuel-economy technologies are at various stages of development.

How high can we expect gas mileage to get? Several car makers have already produced prototype vehicles that get 70 mpg or better. A combination of light materials and a two-cylinder engine have gotten Peugeot's ECO 2000 70 mpg city, 77 mpg highway. Renault's VESTA 2, in which light materials are used extensively, has rated 78 mpg city and an incredible 107 mpg highway. (A number of diesel-engine prototypes have also been developed. However, environmentalists point out that diesels, though relatively fuel-efficient, spew out worrisome toxic exhaust.)

All the above technologies lead many energy-conservation advocates and global-warming analysts to believe that the average new car should get 45 mpg by the year 2000.

A KICK IN THE PANTS

Considering the potential gravity of the global-warming problem, a fuel-efficiency standard of 45 mpg by the turn of the century does not seem unreasonable. But don't hold your breath: The prospect that many promising fuel-economy technologies will be put into production anytime soon is unlikely. Unlikely, that is, unless Congress gives car makers — and us, the American drivers — a kick in the pants.

American car makers abandoned fuel economy as a strategic goal when the oil glut hit in the mid 1980s. Under the circumstances, they're not optimistic about how much fuel efficiency is possible. If Detroit had its druthers, no new government policies to boost fuel economy would be put in place. Because the price of oil is currently low, and because the price of oil doesn't reflect its environmental costs (such as air pollution and global warming), the fuel efficiency of new cars would slowly increase to an average 30 mpg by the turn of the century. (American car makers had their druthers during the Reagan administration. The new car standard was supposed to reach 27.5 mpg by 1985. The standard was relaxed to 26 mpg between 1986 and 1988.)

American car makers argue that many of the estimates of fuel-economy improvements that can be wrung out of a particular technology are way too high. Moving new technologies from the lab and the test track to the showroom, they say, involves numerous engineering compromises to allow for efficient manufacturing and practical servicing. In addition, Detroit is skeptical of the importance of high-mileage prototypes in predicting consumer appeal, noting that prototypes are designed solely to break fuel-economy records, not to compete in the marketplace.

Some of this is certainly true. But as Gregg Easterbrook noted recently in *Newsweek*, faced with the prospect of increased regulation, American industry has almost always cried wolf. For example, when auto-emission controls were legislated in 1970, U.S. car makers went into mourning. Nevertheless, wrote Easterbrook, "After the obligatory dirge of mournful protests — FEDERAL STANDARD IMPOSSIBLE, AUTOMAKERS DECLARE is a typical headline from 1970 — Detroit hit the target without lasting pain." The threat of global warming is so serious, it's not unreasonable to ask auto makers to go out of their way to make fuel-efficient cars.

GAS GUZZLERS

W

hen you think of gas guzzlers, you probably think of cars with jacked-up rear ends, huge tires, lousy mufflers, and names like Charger and Fury. Well, think again. Some of the priciest yuppie cars were slapped with the Environmental Protection Agency's "gas-guzzler" tax this year.

EPA's gas-guzzler tax went into effect in 1980. The tax is based on a car's combined fuel economy (with city fuel economy weighed at 55 percent and highway at 45 percent). Any car that gets less than 22.5 miles per gallon is subject to the tax. The tax starts at \$500 (for cars getting 22 to 22.5 mpg) and goes up to \$3850 (for cars that get 12.5 mpg or less).

The biggest gas guzzler sold in the U.S. this year is the Aston Martin Lagonda (8 mpg city, 11 mpg highway). The Rolls Royce Corniche (10 mpg city, 12 mpg highway) runs a close second.

The following is a sampling of other official 1989 gas guzzlers:

MPG CITY/MPG HIGHWAY		
• Cadillac Allante	15	23
• Porsche 911	13	20
• Porsche 928 S4	14	22
• Jaguar XJS	12	16
• BMW 535i	15	19
• BMW 735i	15	19
• Mercedes-Benz 300SE	17	19
• Mercedes-Benz 560SL	14	17
• Chrysler Fifth Avenue	16	22
• Dodge Diplomat	16	22
• Plymouth Grand Fury	16	22
• Volvo 760	17	21
• Ferrari Testarossa	10	15

— Janet Marinelli &
Bruno R. Tedeschi

GAS SIPPERS

In EPA's 1989 Gas Mileage Guide, the following models rated in the 30s or higher for both city and highway driving*:

MPG CITY/MPG HIGHWAY

SUBCOMPACTS

	MPG CITY	MPG HIGHWAY
• Geo Metro (manual)	53	58
• Geo Metro LSi (automatic)	38	40
• Honda Civic CRX HF (manual)	50	56
• Daihatsu Charade (manual)	38	42
• Ford Festiva (manual)	39	43
• Ford Festiva (automatic)	30	31
• Honda Civic (manual)	34	38
• Isuzu I-Mark (manual)	37	41
• Isuzu I-Mark (automatic)	31	33
• Mitsubishi Mirage (manual)	32	38
• Plymouth Colt (manual)	32	38
• Subaru Justy (manual)	34	37
• Subaru Justy (automatic)	34	35
• Suzuki Swift (automatic)	31	34
• Toyota Tercel (manual)	35	41

COMPACTS:

	MPG CITY	MPG HIGHWAY
• Ford Escort (manual)	32	42
• Pontiac Lemans (manual)	31	40

SMALL STATION WAGONS:

	MPG CITY	MPG HIGHWAY
• Plymouth & Dodge Colt (manual)	30	35
• Honda Civic (manual)	31	35
• Mitsubishi Mirage (manual)	30	35
• Toyota Corolla (manual)	30	35

* Where EPA listed more than one gas mileage for a car (depending on engine size, cylinders, etc.), we listed only the highest.

— Janet Marinelli

The auto makers' strongest argument is that consumers want big cars. We will have to make some sacrifices, too. But would it really be that bad? We demonstrated in the 1970s that we could learn to love smaller, fuel-efficient cars.

No sacrifices are likely if the government doesn't make it worth our while. So what should the government do?

The official message has to be that the threat of global warming is so grave, we must start doing something right away. Those to whom we entrust public education and legislation should point out that steps like increasing fuel efficiency make sense even if global warming fails to live up to predictions. For example, we'd be reducing our dependence on foreign oil—which last year rose above 50 percent for the first time since the 1970s. What's more, reducing oil imports would bring our massive trade deficit down. Buying oil from abroad accounted for almost \$41 billion of our \$118 billion trade deficit last year.

To spur Detroit into action, Congress needs to enact higher fuel-efficiency standards. In 1975, it passed the so-called CAFE (Corporate Average Fuel Economy) law. Despite the rollbacks during the Reagan administration, the program has been a resounding success—"one of the most successful conservation programs in the United States or the world," in the words of Deborah Lynn Bleviss. According to Drusilla Schmidt-Perkins of Environmental Action Foundation, raising the fuel economy standards to 45 mpg by the year 2000 would save 1.1 million barrels of oil a day by the turn of the century and cut the trade deficit by \$10 to \$15 billion a year. It would also reduce the nation's total CO₂ emissions about 4 percent—about one-fifth of the total reductions environmentalists say are needed by the year 2000. In addition, federal regulators need to ensure that auto makers use the technology at hand to give us cars that are safe as well as fuel efficient.

To wean consumers back off gas guzzlers, Congress should consider beefing up the "gas guzzler" tax it passed 11 years ago. The tax is designed to penalize the purchasers of very inefficient new cars. ("Inefficient" is currently defined as under 22.5 miles per gallon.) At its current range of \$500 to \$3,850, however, the gas-guzzler tax does little to punish the folks who buy Mercedes-Benzes and BMWs (see "Gas Guzzlers," page 34). And while lawmakers are at it, they should consider moving the popular jeeps, small pickups, and minivans into the passenger-car category so that they can be subject to the gas-guzzler tax, too. They should also mandate higher fuel-efficiency standards for these vehicles.

And, Washington, you know how we taxpayers fall for rebates. Why not establish a gas-sipper rebate program to reward us for putting up with fuel-efficient (read "smaller") cars? It could be funded at least partially by using revenue from the tax on gas guzzlers.

State governments could pitch in by setting sales taxes and vehicle-registration fees on a sliding scale that penalizes gas guzzlers and rewards gas sippers.

In a year or two, it'll be time to retire my car (a 1980 VW Scirocco that gets 22 mpg, I sheepishly admit) and buy a new one. I'll be looking for a car that's safe, reasonably fun to drive, and extremely fuel efficient. Something like the Honda CRX.

Detroit, this is an American consumer calling. We're all in this together, and we want some sound guidance. Is anybody listening?

How They Fit In

Efforts to promote alternatives to gasoline are gaining momentum. Using alternative fuels could cut emissions of unhealthy carbon monoxide and produce less smog. But some alternative fuels would make the global-warming problem worse.

Attention centers on methanol and natural gas (either compressed or liquified) and, to a lesser degree, ethanol and electricity. Last year, Congress passed a law encouraging car makers to mass-produce vehicles that can run on alternative fuels. To help reduce air pollution in major cities, the Bush administration has called for the production of a million alternative-fueled vehicles annually by 1997. Earlier this year, Metropolitan Los Angeles, the mecca of the automotive culture, announced a plan to require alternative fuels in 40 percent of cars within a decade and in all cars by 2007, technology permitting.

Cleaner air is only one of the driving forces behind alternative fuels. Public officials are also looking for

ways to reduce the amount of oil we import. Cutting oil imports would enhance national security and reduce our massive trade deficit.

Ethanol in this country is currently manufactured from an all-American material — corn. Methanol is now obtained from natural gas. However, an estimated three-quarters of the world's exportable gas reserves are in the Soviet Union, Iran, Abu Dhabi, and Qatar — a potential problem for cars powered directly by natural gas as well. Methanol can also be produced from coal, which we have in plentiful supply. But compared to gasoline, this is still quite expensive. In addition, methanol can be produced from wood and forest residues, but the industry that would produce this fuel is in its infancy. The attraction of electric vehicles is that they can be powered by many different sources: solar photovoltaic cells mounted on the vehicle itself or solar, nuclear, hydro, geothermal, natural gas, or coal generating plants.

At the moment, none of these alternatives can compete with gasoline in cost.

According to a handful of recent studies, big reductions in emissions of carbon dioxide, the major greenhouse gas, would be possible if we switched to vehicles that run on ethanol, methanol, or natural gas made from wood, agricultural wastes, and other "biomass," or on electricity that isn't generated by burning coal. Switching to coal-based alternative fuels like methanol and synthetic natural gas would exacerbate the build-up of CO₂ — and the threat of global warming.

The chart on the opposite page shows how the environmental impacts of the four leading alternative fuels compare with gasoline. Hydrogen gas may be the most environmentally sound vehicle fuel, but development is further in the future.

- Janet Marinelli



Solar cells power a fan that helps cool this Saab prototype.

FUEL***ADVANTAGES****DISADVANTAGES****CURRENT USES****Ethanol**

Ethanol-gasoline blends emit less carbon monoxide than gas. Ethanol has a distinct advantage over gasoline in reduced emissions of CO₂, the major greenhouse gas.

Even if the nation's entire corn harvest was devoted to ethanol, it would satisfy less than 20% of our motor-vehicle fuel needs at current vehicle fuel efficiency. Emissions of aldehydes pose a potential smog problem.

Used in the U.S. primarily as a 10% blend with gasoline, called gasohol. Approximately 880 million gallons per year of ethanol were used for gasohol in 1988. Ethanol provided roughly half of Brazil's automotive fuel in 1986.

Methanol

Produces only negligible amounts of the highly reactive hydrocarbons that produce smog if proper pollution controls are used. Methanol from wood and other "biomass" fuels would emit less CO₂ than gasoline and thus reduce the threat of global warming.

Significant emissions of aldehydes, including formaldehyde, a probable human carcinogen. Methanol from coal would greatly increase CO₂ emissions.

Large-scale testing in California state vehicles. Some testing in buses across the country.

Natural Gas

Extremely clean burning. Slight to moderate reductions in CO₂ emissions, compared to gasoline. Synthetic natural gas made from agricultural & forest residues & other biomass would substantially reduce CO₂ emissions.

Nitrogen oxide emissions could increase. The use of synthetic natural gas from coal would increase CO₂ emissions considerably.

Fuels tens of thousands of utility vehicles worldwide. Is being tested in buses in several locations. Used widely in cars and commercial vehicles in British Columbia.

Electricity

Electric vehicles themselves emit almost no pollution. Quiet operation. Great for stop-&-go city traffic, as when they aren't moving, they use no energy. Electricity from nuclear, solar, or hydro would power these vehicles without producing CO₂ emissions.

If the electricity to charge the batteries of electric vehicles came from new coal plants, CO₂ emissions would be greater than gasoline-powered cars. If the electricity came from nuclear plants, radioactive-waste disposal would become an even more pressing problem.

Used in some electric utility and Postal Service vehicles.

*Calculations of CO₂ emissions include emissions from fuel production and use. For biomass-based fuels like ethanol, the calculations also include CO₂ absorption by the crops used to produce the fuels.



ORGANIC FOODS

Are You Getting What You Pay For?

by **Ginia Bellafante**

In preparation for this article, I attended an organic-farming conference. It was held by the Natural Organic Farmers' Association, a New England group. On my bus ride north, I happened to sit next to a businessman. We chatted and he offered that he himself had done some organic farming—in Ithaca, New York, about twenty years ago.

"What did you grow?" I asked.

"Oh, a little of this and a little of that," he chuckled.

Hmmmm. I suspected "this" might have been a few heads of splotchy broccoli and "that" might have caused the munchies. Here he was today, well dressed, a Manhattan attorney, a parent.

My seat-mate's lifestyle changes pretty much mirror the recent history of organic gardening.

No longer a counter-culture occupation, organic farming—the practice of growing fruits, vegetables, and grains without chemically synthesized pesticides, fertilizers, fungicides, herbicides, or post-harvest preservatives—has become a respected science. Universities offer degree programs in environmentally sound farming techniques. Chemical companies including Du Pont and Monsanto are researching ways that bioengineering can be used to deter pests naturally.

Organic farming is also becoming big business. Huge growers such as Dole and Sunkist have begun to set aside land for chemical-free farming. Across the country, organic produce is making its way onto the shelves of major supermarket chains—and into the *haute-cuisine* dishes of some top chefs, who insist that organic greens taste far better than those grown conventionally. On the average, fruits and vegetables grown without pesticides cost 15 to 30 percent more than ordinary produce. In some parts of the country last fall, organically grown apples sold for a \$1 a piece, and last winter tomatoes went for about \$3 per pound. It's not unheard of for organic produce to command prices twice that of "regular" produce.

When we're paying that much for food, we want to be sure that we're getting our money's worth. But, the regulation of organic foods is still spotty. Organic produce comprises about one percent of this country's total yearly agricultural supply, but the

Wall Street Journal has predicted a nine-fold growth in organic-foods production over the next ten years. In the absence of an enforced regulatory system, the expansion of the organics market is likely to be accompanied by instances of fraud.

THE PANIC FOR ORGANIC

Americans are worried about the safety of their food. Two surveys attest to growing consumer concern about pesticide residues. A survey of 1,031 Americans conducted by the Food Marketing Institute, an industry group, found that 82 percent considered pesticides in foods a serious hazard, up from 77 percent in 1982. A poll by Louis Harris for *Organic Gardening* magazine found that 84 percent of 1,250 randomly selected adults would buy organic produce if it cost no more than regular produce. Half of the respondents said they'd pay more for organic.

The daily papers are full of reports warning us that some pesticides have been linked to cancer and birth defects, and that others may be damaging to the immune, nervous, and reproductive systems. Of the 600 pesticides registered with the U.S. Environmental Protection Agency (EPA)*, 496 are known to leave residues on food. In October 1988, the EPA reported that there is at least "limited evidence" that 66 of the pesticides sold for use on food crops may be carcinogenic. Environmentalists and scientists outside the agency consider that an underestimation. The EPA itself admits that the number is expected to grow as the agency evaluates more studies on pesticides used for food.

Over the years, the EPA's pesticide-management policies have been repeatedly criticized by scientists, environmentalists, and consumer advocates. EPA's critics have three major complaints. First, they claim the EPA does not adequately test a pesticide's ability to cause cancer or other health problems. For example, the EPA doesn't require that testing be performed on the toxicity of inert ingredients in pesticides. (An inert ingredient is a substance in a pesticide that is not intended to kill or control the target pest. Materials often used are solvents, emulsifiers, and

*The EPA regulates the sale and use of pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act. To register a pesticide, the EPA must determine that the chemical will not cause "unreasonable adverse effects" to human beings or the environment. Manufacturers are required to perform health and safety tests on pesticides, but often the EPA will permit companies to sell pesticides before all necessary testing has been performed.



dilutents.) Second, EPA's critics contend that the agency sets human tolerance levels to pesticides that are way too high. (A tolerance level is the level at which pesticide residues may be present on food without endangering human health. Different limits are set for different pesticides, as well as for each crop on which a particular pesticide may be applied.) Third, critics also say the EPA does not move quickly enough to ban pesticides strongly suspected of being carcinogenic, as in the case of Alar, a chemical growth enhancer used primarily on apples (see "Lifting the Lid," page 17 in the September/October issue).

Generally, those who fault the EPA for inadequately regulating pesticides also point to shortcomings in the Food and Drug Administration's procedure for making sure that pesticide residues on produce fall within EPA limits. (The FDA supervises the safety of food sold across state lines.) Although the FDA claims that less than one percent of the fresh foods tested for pesticide residues had exceeded federal tolerance levels in 1987, The U.S. General Accounting Office, a research arm of Congress, found that the FDA's pesticide-monitoring procedures cannot detect 60 percent of the pesticides likely to appear on food. The FDA's six regional offices and 21 district offices currently inspect only about one percent of the food supply.

• WHAT ORGANIC MEANS

Under the circumstances, it's not surprising that people are clamoring for organic foods. But be aware that there is no national definition of organic. Some states regulate the organic-foods industry (see box on page 41), but the federal government does not.

There are respected, reputable certifiers at work in states that don't regulate organic farming. But we should be wary and aware of the requirements a particular certifier imposes on its growers. There are approximately 40 organizations in the United States right now that scrutinize the farming methods of growers who want the credibility that comes from being "certified organic." Most of these organizations certify foods exclusively in their own region. Farmers apply for certification voluntarily and generally pay about \$150 to do so. The cost of mandated soil tests is additional. Certification committees are usually made up of about 50 percent farmers, and 50 percent consumers and agricultural specialists.

The guidelines issued by various certifiers differ slightly. Many specify that a certified organic farmer be growing on soil that has not been treated with any chemicals for three years. Others demand that soil be untreated with pesticides for three years, but free of chemical fertilizers for only one or two years. Certifiers usually govern not only what farmers can't use, but also what they can and should use to produce healthy crops. These organizations generally instruct farmers to deter pests by rotating crops and using botanically derived pest controls and natural predators; to keep weeds in check by planting cover crops; and to fertilize soil using only "natural organic" fertilizers like blood and bone meal, and composts made from manure and food and yard wastes. Nutrient-enriching cover crops and compost are vital for healthy erosion-resistant soil as well as healthy plants.

When a farmer applies for certification, he or she must supply the certifying group with supporting materials: an extensive questionnaire on farm practices, including cropping and pest-management histories, a notarized affidavit attesting that the information contained is accurate, and a complete record (known as an audit trail) of where all raw materials used on the farm came from (purchase orders, bills, inventory reports, and so on). In addition, if a farmer has divided his farm into sections of organically grown crops and chemically grown crops, he must demonstrate that measures have been taken to eliminate pesticide contamination from one to the other. Farmers must also show certifiers that storage areas for all commodities are well ventilated and sealed against birds, rodents, and other pests.

When all documentation has been submitted, many committees hire what is known as a third-party inspector to visit the farm and observe growing practices first hand. Third-party inspectors, independent agricultural specialists with no financial interest in the organic-foods market, are usually well versed in both conventional- and organic-farming methods.

During an initial visit, the inspector usually collects soil samples and sends them to an independent lab where they are screened for pesticide residues. If, after examining a farmer's growing history, the inspector suspects that a particular pesticide may be lingering in soil or plant tissue, he can require an additional, chemical-specific test. If residues do show up, the farmer is usually asked to move his crop to another field and is re-tested for certification the following year. Because certain chemicals may drift onto an organic farm from adjacent farms, organic farmers and certifiers need to know the types of chemicals being applied to those neighboring farms so residue tests for those chemicals can be conducted as well.

Among other things, inspectors also check to see that crops have been rotated and that compost has been added to the soil. Additional soil tests that measure the fertility and nutrient levels in soil are conducted during the first visit, and routinely thereafter if the farmer is certified. Once a grower has been certified, an inspector visits at least once yearly.

A certification program cannot, of course, guarantee that each fruit or vegetable bear-



cide on her orchard once during the growing season than to apply sulfur, a pest control which is acceptable to most certifiers but which depletes the soil of minerals, 50 or 60 times before harvest. Other farmers at the conference were organic purists who eschew the use of chemicals completely.

Robert Scowcroft and Bob Quinn, internal review committee chairman at the Organic Crop Improvement Association, another independent certifier, are both in favor of a national definition but oppose government certification. "We don't need another bureaucracy," says Mr. Scowcroft, "but what we would like to see is a public-private partnership with organizations like CCOF overseeing certification regionally, under the auspices of the government." Keith Jones

at the Texas Department of Agriculture also supports a national definition but feels the Fowler bill is vague and watered down. He notes that the bill states that pest control should be accomplished by "ecological" and "biological" means but doesn't specify what those are. A vote on the Fowler bill is expected early next year.

• HOW TO SHOP ORGANIC

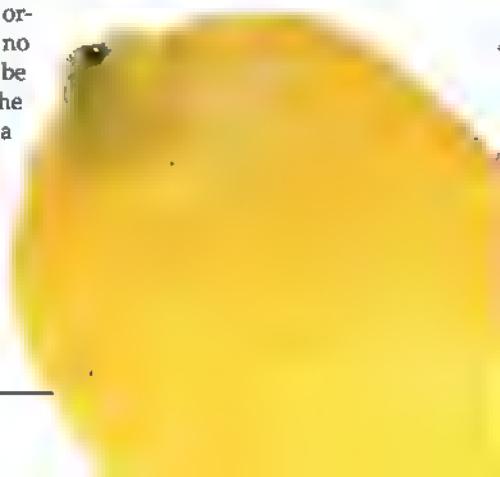
Until organic foods become less costly (which is likely as large distributors begin to see the profits to be made in shipping them) and until they are more uniformly regulated, shoppers need to decide whether or not these fruits and vegetables are worth all the extra cash. Here are some tips to keep in mind:

*Always stick with food labelled "certified organic." In some states, there is no definition of organic and there are no certifiers, state or private. Unless you buy certified organic food shipped from a reputable out-of-state certifier (see page 41 for a list of mail-order, certified-organic-food suppliers), the chances are high you'd be wasting your money on "organic" food just labelled organic.

*In states that have legislated a definition of organic but do not themselves certify or contract out to an independent certification group, inspection of organic food may be minimal or non-existent. On the other hand, there may be one or more extremely reputable private certifiers in the area. If you live in one of these states, you must learn about the requirements those certifiers impose on organic farmers.

*All produce labelled "certified organic" should include the name of the certifying body. You may decide that food certified by an organization that does *not* require farms to be free of pesticides and chemical fertilizers for three years simply isn't worth the premium price. Send a self-addressed stamped envelope to the Organic Foods Production Association of North America, P.O. Box 1, Belchertown, MA 01007 for a complete list of certifiers across the country. Certifiers should send you their guidelines upon request.

*Buy directly from farmers when you can. Because organic produce contains no preservatives, it may not be fresh by the time it gets to the supermarket. If you find a farmer that claims to be growing organic produce but isn't certified, ask him how he controls pests and weeds. And ask him how he fertilizes his soil.



ing its seal is absolutely free of chemical residue. Spray drift from neighboring farms and contamination from air and water pollution leave residues of pesticides that are too small for standard tests to detect. Jennifer Curtis, a research specialist at the Natural Resources Defense Council, a national environmental group, says labels claiming food is "pesticide-free" are overstated. "You could find pesticide residues in parts per trillion if tests were sophisticated enough," says Robert Scowcroft, the executive director of California Certified Organic Farmers (CCOF), an independent certification agency. Ms. Curtis also points out that despite being required by law to have developed residue tests for pesticides put on the market, many chemical manufacturers are slow to do so. "There are chemicals we have no idea how to test for," she says.

• THE FUTURE OF ORGANIC FOODS

A surefire guarantee that an item of produce marked "certified organic" is 100 percent chemical-free may never be possible. But there are ways to ensure that the organic produce you're buying is reasonably pesticide-free — and fairly priced. State-by-state definitions of organic not only make it difficult for us to know what we're getting, but they also create enormous obstacles for those trying to market organic produce across state lines. This in turn keeps supplies low and prices high.

A national definition of organic, one that would stipulate for how long a farm must be chemical-free, could eliminate much of this confusion. Senator Wyke Fowler of Georgia has introduced an amendment to the 1990 farm bill that would require that a farm be chemical-free for three years to qualify as organic. It also calls for the formation of an Organic Food Commission "to determine the feasibility and advisability of establishing a national program for the certification of organic food." Indiana Senator Richard Lugar has also sponsored a bill that calls for a reduction of chemical use on farms; but the bill doesn't specifically address the issue of organic farming.

Reaction among organic growers and certifiers to the Fowler bill is mixed. Nowhere was this more evident than at that Natural Organic Farmers Conference I attended in July. Some of the farmers preferred a national definition that wouldn't outlaw pesticides completely, but rather allow for minimal use under certain conditions. One New York State apple grower pointed out that it was probably more prudent for her to spray a low-toxicity pesti-

Status of Organic State by State

States that define organic for labelling purposes, i.e. organic has a legal meaning but the states don't inspect organic farms to see that definition is adhered to:

**California
Connecticut
Iowa
Maine
Massachusetts
Montana
Nebraska
North Dakota
Oregon
South Dakota**

There are four distinct ways a state may be involved in supervising organics: (1) A state may legislate a definition of organic and certify or inspect farmers who grow organically. (2) A state may define "organic" legally, but contract out inspection to an independent certification organization. (3) A state may merely legislate a definition of organic for labeling purposes but may not check to see that food labelled organic is grown in accordance with that definition. Independent certifiers may operate in these states, however. (4) A state may have absolutely no legislation on organic growing. Independent certifiers do exist in many — but not all — of these states.

Seventeen states (see above) have regulations or laws pertaining to organic food. However, legislation differs considerably from state to state. Consequently, an organic apple grown in Massachusetts may not qualify as such in Texas. A California statute, for example, permits food to be labelled organic if it has been grown on soil treated without chemicals for one year. A Texas law requires that organic food come from farmland that has been pesticide-free for three years — the time it usually takes for residues to disappear — but free of chemical fertilizers for only one year.

How these states ensure that growers are complying with state stan-

States that define organic and contract out to independent certifiers who do the actual certification:

**Minnesota
Ohio**

States that define organic and do the actual certification:

**Colorado
New Hampshire
Oklahoma
Texas
Washington**

dards is another thorny issue. Only Texas, Washington, Colorado, Oklahoma, and New Hampshire actually certify that organic merchandise has been grown in accordance with state-approved standards. Judgements as to who may be certified are based on comprehensive examination of a grower's practices and a series of soil tests. The Texas Department of Agriculture not only enforces its standards, but also aggressively markets the organic produce it certifies. According to Keith Jones at the Texas Department of Agriculture, 10 percent of the produce in the state's major chains, HEB, Tom Thumb, and Apple Tree, is certified by the state.

A Minnesota statute requires that produce labelled "certified organic" be certified as such by the Organic Growers and Buyers Association, a private, non-profit certifying body based in that state. Minnesota was the first state to form a co-operative relationship with an independent certifier. Other states have begun to follow suit.

Mail-Order Suppliers of Certified Organic Foods

The following suppliers ship nationwide. Write or call for a complete product list:

Living Farms
Box 50
Tracy, Minnesota 56175
(800) 533-5320
(Grains)

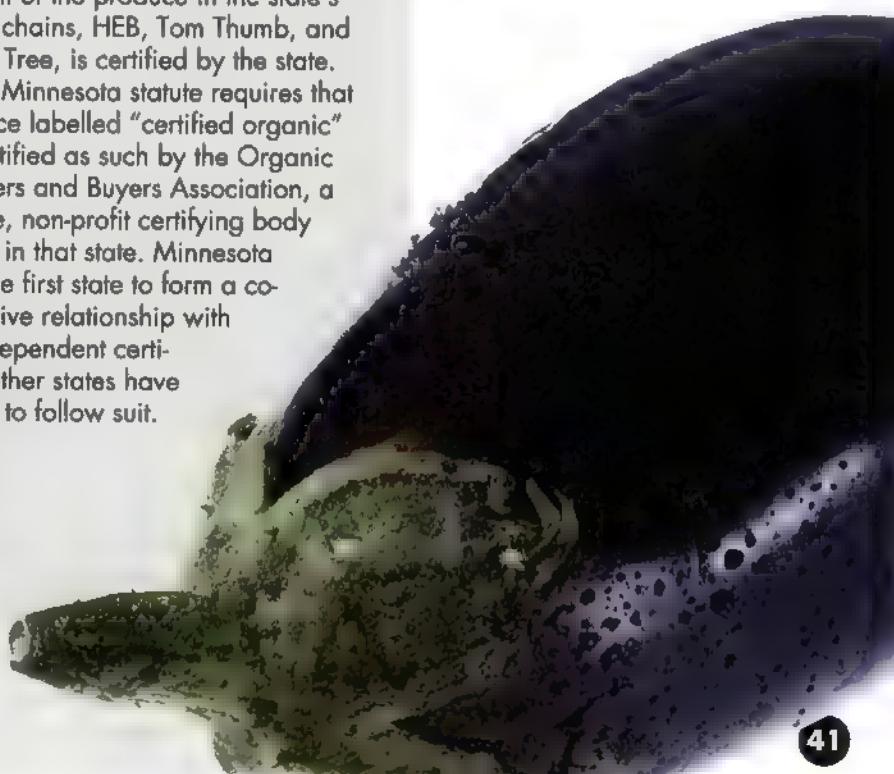
Farmers Wholesale Cooperative
P O. Box 7446
Olympia, WA 98507
(206) 754-8989
(Full line of products)

Stanley Jacobson
1505 Doherty
Mission, Texas 78572
(512) 585-1712
(Citrus fruits)

Blue Heron Farms
P O. Box 68
Rumsey, CA 95679
(916) 796-3799
(Oranges, almonds, walnuts)

Natural Way Mills, Inc.
Rt. 2, Box 37
Middle River, MN 56737
(218) 222-3677
(Whole grains, flours)

Sleepy Hollow Farm
44001 Dunlap Road
Miramonte, CA 93641
(209) 336-2444
(Apples, cooking herbs)



The Other Organics



never been treated with synthetic growth hormones or "subtherapeutic" antibiotics (drugs administered to prevent disease).

Some researchers suspect that growth hormones leave people vulnerable to strains of *Salmonella* that are not easily curable.

The European market became so concerned about the effects of growth hormones on human beings that it stopped buying American meat treated with those hormones last January. Some scientists also claim that the antibiotics used by ranchers may cause cancer.

Certifiers who deal with livestock claim that few ranchers can meet their standards, in part because supplies of organic feed are limited. As a result, the amount of certified organic meat and poultry available is small. Certified organic milk and eggs must come from certified organic livestock, and as a consequence supplies of organic

dairy products are just as slim.

Breads, pastas, and other processed-grain foods labelled organic should contain only ingredients that have been grown organically. These products should also be free of any chemical preservatives or processed additives. The Organic Crop Improvement Association (OCIA) is the most respected nationwide certifier of processed foods manufacturers claim are organic. Steer clear of products that do not bear the OCIA label because they may not be worth the additional cost.



Finding reputable sources of organically grown meats, dairy products, breads, cereals, etc., is even more of a challenge than finding organic produce. Very few certifiers have devised standards for these foods.

The few organizations that have set guidelines for livestock require that certified organic meat and poultry come from animals that have been fed only organically grown grains, and have

A Buyer's Guide to Organic Terms



It's easy to get lost in the thicket of technical terms used by organic growers and certifiers. To make shoppers' lives easier, we put together the following guide to organic terminology:

Biodynamic/biointensive: A method of organic farming based on the writings and lectures of Austrian philosopher

Rudolph Steiner and biochemist Ehrenfried Pfeiffer. The two men recommend the use of highly complicated and often peculiar compost recipes. Followers of the biodynamic method may be certified organic, but not necessarily.

Certified Organic: Certified organic farms have been carefully inspected by either a representative of a state department of agriculture or a private certification group to verify that a grower has used absolutely no chemicals on his farm for a specified period of time (usually one, two, or three years). This is your best guarantee that you're getting what you paid for.

Integrated Pest Management (IPM): IPM crops are grown using a combination of biological and chemical methods, with the emphasis on reducing the amount of synthetic pesticides used.

Natural: A marketing gimmick used frequently on processed foods, which means absolutely nothing.

Pesticide-free/chemical-free: Buyer beware! This term does not mean produce has been grown organically. The

only way to be sure that food is reasonably free of pesticides is to buy those items labelled "certified organic."

Transitional Organic: This phrase implies that the grower has switched from chemically intensive farming to organic methods but must wait one to three years, depending on the rules of his certifier or his state, before his produce can be labelled organic or certified organic. Most chemical residues disappear over a one- to three-year period.

Unsprayed: Unsprayed means that the edible parts of a crop have not been treated with pesticides, although synthetic fertilizers and fungicides may have been used in the soil.

Photos: Robert Kourik



COMPOST OR WHAT?

A '70s Passion Reworked for the Pragmatic '90s

BY ROBERT KOURIK

R

member when you first discovered those metal-petaled steamers for cooking your veggies? Remember boasting about your ordeal on the gas-station line, not the autoteller line? Remember those innocent days when Arlo Guthrie sang about a dump, not a "sanitary landfill" (which we would later discover was seeping into the town's water supply)?

Robert Kourik wrote Designing and Maintaining Your Edible Landscape — Naturally. He'll be writing for GARBAGE on environmentally sound gardening techniques. Robert lives near Occidental, California

Remember composting?

Maybe not. Compost didn't even rate a background mention in "The Big Chill." And have you seen many real compost piles lately — you know, the kind promoted by the proselytizers of compost in the late 1960s and early '70s, the kind that were painstakingly layered, achieved temperatures of 140 degrees F, and decomposed even the starchiest cornstalk in four to six weeks? While a pile or two of garden refuse may be hidden in the dark corners of some American gardens even today, these well-formed, "hot" or active compost piles are increasingly rare. Active composting slipped rapidly into obscurity as our lives were swept into the '80s and we took on mortgages with an



Ahh...headbands, long hair, bellbottoms, and compost bins.

alarming number of zeros. Some ardent proponents of composting have survived in the organic-gardening backwaters of the past decade, but even many former captains of compost have given up on their active piles.

However.... The problems that sparked an interest in composting 10 or 20 years ago have not disappeared. They've gotten worse. New York City, for example, is constructing a shrine to garbage — a pyramid-shaped, 505-foot-tall dump on Staten Island called the Fresh Kills Landfill. When completed sometime around 2005, this monumental trash heap will be taller than the largest pyramid in Egypt, will tower 200 feet higher than the nearby Statue of Liberty, and will hold a staggering 50 million tons of garbage. It's estimated that 20 to 30 percent of the trash in this legacy of modern waste management will consist of kitchen scraps and garden refuse. Percentages are similar nationwide.

What can home gardeners do about slimy kitchen scraps and piles of garden waste? Hot composting never caught on, but there are simpler ways to recycle them.* First, a quick history lesson.

• CONFESSIONS OF A COMPOST EVANGELIST

I was, alas, an outspoken proponent of the virtues and healing properties of, the magic surrounding, and the essential need for Compost (with a capital "C"). I began my career as an organic

*Hundreds of cities, counties, and private companies now compost leaves or mixed yard wastes on a large scale. We'll tell you about their efforts in an upcoming issue.—the editors

gardener convinced that compost was the Queen of Panaceas for my garden — and all gardens. I loved to make compost. Watching the four-foot piles begin to steam in the brisk early-morning air was nirvana. Turning the steaming, fragrant compost piles (the pungent aroma of decomposition—tinted with ammonia, sulphur, musk, and wet dirt—is delicious to the devotee) was a mystical, if not religious, experience.

Not only did I make literally tons of compost for my garden, but I persuaded through sheer enthusiasm nearly all of my landscape clients that they had to have a neat, tidy set of compost bins for their own "cookin' compost." These bins were made after the fashion of those promoted by the Farallones Institute Integral Urban House in Berkeley, California, in the 1970s, a magnet for proponents of environmentally sound city and suburban living. With several of the folks who'd worked at the Integral Urban House, I installed my first "edible" landscape design, complete with a four-bin compost system stair-stepped down a steep hill in Oakland. (An edible landscape combines plants that are as nutritious and flavorful as they are beautiful into a unified, dynamic whole — unlike conventional landscaping, which shatters the property into a single row of junipers here, a row of petunias there, and a vegetable patch in the backyard. But this is a subject for a future issue.)

In those days, I expected my clients to gather up their daily kitchen waste, layer it with sawdust in a 30-gallon garbage can and, when enough scraps had accumulated, construct a hot-compost pile in a bin by alternating layers of garden clippings, manure, and straw. Furthermore, in my heady idealism, I ex-



Unfortunately, the compost bins became toolsheds within six months.

pected my clients to stir the pile every week or two until the temperature began to drop some four to six weeks later. I gave them reading assignments on the importance of compost and on recipes for the well-layered pile. And I expected them to enjoy this onerous, odiferous task.

REALITY CREEPS INTO THE CHURCH OF COMPOST

Lo and behold, in a few short years, all but one of the bin systems I'd made for my clients had been turned into boxy little toolsheds. And the one bin system still used for composting was not a true, hot compost pile at all. It had become a rotten former shadow of itself, a mere heap of landscape clippings that nature was slowly turning into a fibrous, nutritionally worthless pile of mulch.

As a fanatic, full-time gardener with a *cause célèbre* about hot compost piles, I had failed to look at my clients' lifestyles and listen to their tales of being overworked and hideously busy. They wanted at best to garden as a relaxing break from the pressures of the week. To them, turning 500 pounds of stinking, hot, rotten garbage was not a sacred chore. Imagine! In hindsight, it's obvious that the gathering and layering of all the prerequisite raw materials, not to mention the turning of the piles, just didn't suit my suburban clients' lifestyles.

The same thing happened at the Farallones Institute Rural Center near Occidental, California, where I moved in 1981 to start an edible-landscape program. Compost-bin design and construction was part of the curriculum. Course participants worked in

teams to build some six or eight bins. In my idealism (or blindness), I'd assumed the Rural Center gardeners were just dying to make compost in these tidy, varmint-proof bins. The bins went unused until they were reborn as storage spaces for tools and potting soil for the greenhouse — which is what they're used for today. The three acres of intensively cultivated gardens at the Center required so much compost that the tiny amounts that could've been made in the bins would've been like spittin' in the wind.

I'd made a fundamental error. I'd misjudged the entire sociology of the system. The biology of composting is relatively simple, elegant, and easily implemented by an enthusiastic person. But what's important about hot composting is *whether or not it fits into your lifestyle*. The most crucial elements in a backyard ecosystem are the homeowners and gardeners. Don't build a compost-bin system without carefully considering how much time you have to garden, whether your lower back is up to the task, and whether there is a more suitable alternative.

COMPOSTING TECHNIQUES

• Hot Compost

During my early days as a compost purist, I practiced the fine art of hot, fast composting in the tradition of the father of composting, Sir Albert Howard. In his work during the early 1930s in the Indore district of India, Howard perfected a way to rapidly decompose agricultural wastes into high-quality compost in just two to four weeks. Hence the name of this kind of composting —

the Indore method (pronounced like "indoor," which lends a certain comic confusion).

Howard's method depends on thermophilic (heat-loving and heat-generating) aerobic (air-loving) bacteria and fungi. A pile a minimum one cubic yard in size (a cube three feet on each side, or about twice the volume of a modern refrigerator) is carefully constructed with layers of pre-moistened, high-carbon materials (straw, wood chips, corn stalks, dried-out leaves) and moist, high-nitrogen refuse (green plant waste, freshly mown grass clippings, any kind of manure except cat, kitchen scraps) in an approximate ratio of 20-to-30 to one.

This ratio of 20-to-30 parts of carbon to one part of nitrogen is the ideal combination for rapid decomposition. There are fancy formulas to calculate the carbon-to-nitrogen ratio (C:N), but they're useless to the home gardener. Basically, you need to get a feel for the types of refuse you'll be using. Wood chips and sawdust have a C:N of 200-767:1, while manures have a C:N of 7-25:1. Dried wheat straw has a C:N of 128:1. Raw kitchen garbage has a ratio of 18-25:1. (Any good book on composting lists carbon-to-nitrogen ratios.)

Simply put, you'll need to add lots of manure, with a low C:N, to a pile that contains straw or sawdust. With a C:N of 3:1, bloodmeal is a great material for balancing the high carbon content of certain woods. By mixing thin layers of various materials, while keeping in mind the relative carbon-to-nitrogen ratio of each, the budding composter can begin to figure out how much of each material is needed for a healthy compost pile. Usually, by your third or fourth pile, you've got a good sense of the proper blend.

The three most important tips for building a hot compost pile are: (1) Strive for this almost magical 20-30:1 ration of carbon to nitrogen. (2) Make sure all material is moist, but not too wet. And (3) Incorporate plenty of air while constructing and turning the pile. Hot compost can be made in bins or free-standing piles.

Begin your pile with a thick layer of woody, bulky material such as the stalks of sunflowers, corn, ornamental flowers, and Jerusalem artichokes. This helps counteract the pile's tendency to settle and reduce the lower levels of the pile to an anaerobic mess. (Anaerobic decomposition, or decomposition by bacteria that don't require the oxygen in air, occurs when the pile has so much water or is so compacted that most of the oxygen is absent. What air was in the pile when it was first built is quickly used by air-loving bacteria. The structure of the pile prevents any more air from infiltrating, so anaerobic bacteria and fungi take over. Anaerobic decomposition's most notable feature is its strong ammonia- and sulphur-like smell.)

Build thin layers of each type of material, making sure to place high-nitrogen material, like kitchen scraps and manures, on top of carbonaceous wastes, such as brown leaves, corn stalks, and sawdust. If the materials are dry, use a hose with a fine-mist nozzle to moisten each layer as you go along. Use very thin layers of materials that compact easily — grass clippings, sawdust, leaves, and the like.

The safest place for kitchen scraps is in the middle of the central layers so that they quickly decompose. Meat and fish scraps will rapidly decompose only if the pile is a well-built, hot, aerobic one. Beginners should avoid them. Avoid citrus rinds, too, as they're virtually decay-proof in all but the most thermophilic piles.

In wet climates, cover the top of the pile with a tarp or scraps of wood or sheet metal (if you're not using a fancy composting bin) to keep the pile from getting soaked. In very warm climates, a layer of straw mulch on top of the pile helps keep its outer edges moist. Composting isn't easy to pull off during winters in the

North, and usually isn't practical once the ground freezes.

Your pile must be turned every two to seven days, so that enough air is incorporated into the pile to keep the aerobic bacteria happy; I usually turned my piles once a week for four weeks. Thermophilic bacteria work so hard that they generate temperatures in the pile ranging from 140 to 160 degrees F — which is what accounts for the "steam" that rises from the pile on cool, moist mornings. Once the pile begins to drop below lukewarm and most of the bulky material has decomposed, the compost is ready to apply either as a surface mulch for your plants or as a soil amendment tilled into the soil. Tilling finished compost into the soil conserves the most nutrients. Using compost as a mulch is a rather extravagant use of the material.

A common misconception about the Indore method is that it conserves more nutrients than any other form of composting. Actually, anaerobic decomposition, especially the kind that goes on at the slurry pits of manure found at some dairy barns, is the most conserving of nitrogen, but the stench and difficulties involved in distributing the slurry make this approach highly impractical for the home gardener. You can mitigate the loss of nitrogen, a vital plant nutrient, from a hot compost pile by adding thin layers of topsoil every foot or so throughout your pile. The soil, particularly its clay and humus content, absorbs some of the nitrogen-rich ammonia gas as it's volatilized by the heat of the pile.

In any case, the finished compost from a hot pile does wonders for ordinary garden soil: It provides a dose of the "big three" plant nutrients — nitrogen, phosphorous, and potash — as well as many micronutrients (which ones depends on the raw materials you use). It provides plenty of organic matter, which helps make clay soils less heavy and better drained, and helps sandy soil hold valuable nutrients that would otherwise leach away with rain or irrigation. It destroys many kinds of "weed" seeds and some pathogens and pests. It even speeds up the breakdown of some synthetic chemical pesticides.

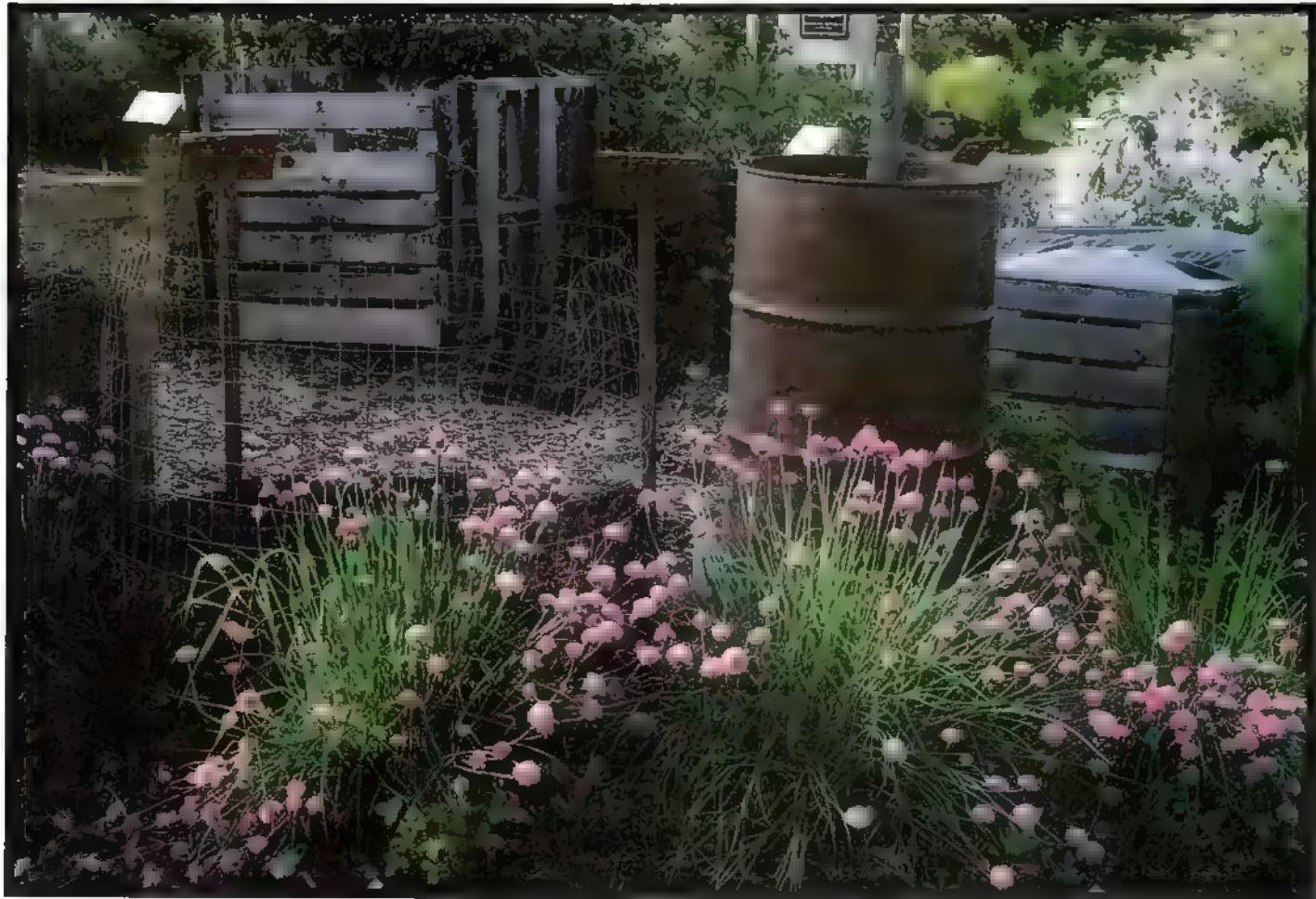
• Compost Drums and Compost Scams

A short digression: There are a number of products on the market that I consider either totally bogus or not worth the money to an accomplished composter.

The best hot compost piles must be at least one cubic yard in size. Virtually none of the expensive plastic or metal compost bins for sale have an interior volume of one cubic yard. I think my Dad has the right idea for a good bin material at an appropriate cost — wooden shipping pallets, for free. (See "How to Build a Bin," page 49.)

Those fancy, off-the-shelf rotating compost drums are also too small; the only thing big about them is their price. I look at the drum process as flameless "incineration." Because the volume of the drum is not adequate for proper thermophilic decomposition, the tumbling has the effect of dehydrating and merely dry-rotting the fresh plant tissue — a process very different from bacterial and fungal decomposition. Dehydration rapidly drives off much of the nitrogen, as nitrogen is so easily volatilized as a gas. What you get is decayed fiber, not nutrient-rich organic matter. And decayed fiber is something that you can get, for free, from a simple compost heap (see below).

Don't take the claims of companies marketing "miracle" compost activators too seriously, either. They ain't worth the money. If you're using fairly fresh manures, fresh kitchen scraps, or some soil, you're getting all the bacteria and fungi you need. If you're trying to compost biologically dead material, like pre-sacked manures and potting soils, then perhaps these compost elixirs can help. All you really need for good compost is the proper ratio of nitrogen to carbon and enough air and moisture.



Composting techniques at a community garden in Seattle, including a "compost" heap, hot compost bins, and a home-made rotating drum.

Another thing to take with a grain of salt: the various compost activators, including stinging nettle, described glowingly in some gardening literature. I've experimented with stinging nettle as a compost activator. I've even tried dried nettle tea. As I didn't have a control pile without nettles, I can't say exactly how effective they were. The piles certainly got hot, but whether they got any hotter than they would have without the nettles is anybody's guess. Certainly, the cost of the nettles wasn't worth whatever minimal effect they had.

Compost aerating tools are also unnecessary. The proper layering of loose, woody prunings or stalks will maintain the proper aerobic levels for free. If your pile turns anaerobic — anaerobic compost piles usually fail to heat up, are wet and slimy, and smell — turn the pile and rebuild it with a looser structure.

• **"Compost" Heaps**

Mesophilic (mild-temperature) and cryophilic (low-temperature) bacteria and fungi can decompose garden wastes. But the cooler the temperature, the slower the decay. Unlike hot composting, which takes four to six weeks, the ordinary rot process takes two to four years.

Compost heaps do have their advantages. With the passing of time, the busy gardener's heap will become high-fiber material for use as a mulch or soil amendment. According to E.W. Russell in *Soil Conditions and Plant Growth*, "The lower the temperature of decomposition ... the higher is the organic nitrogen content of the compost." But don't expect this stuff to be a significant source of

nutrition for your plants, since rainfall leaches away valuable nutrients while the heap sits around rotting. I think of heap compost as merely a material that can improve soil texture. Best of all, it's a form of decomposition that fits easily into the active lifestyle of many gardeners — all you do is add the latest batch of garden refuse to the heap.

One significant drawback of heaps: their tendency to provide habitat for critters of the rodent persuasion. Keep out the kitchen scraps. I usually also place a cylinder of chicken-wire covered with a wire "lid" around compost heaps and locate them far away from the house, preferably behind a screen of shrubbery.

• **Bastard Trenching**

Thanks to my evangelism, my former landlady Jean Berensmeier ended up with a bunch of compost bins. But before she'd been force-fed on this composting technique by me, she had saved kitchen scraps, simply dug a pit or narrow trench, and buried the scraps 12 to 18 inches deep so that possums and raccoons wouldn't uncover them. While I lived at her house, of course, we composted regularly, because I had a pickup truck and plenty of gumption. Once I left, however, my bins became yet again a repository for tools and sacks of fertilizer. Jean promptly went back to what the English call "bastard trenching." (I can just see the crusty English gardener who loathed the activity and gave it its name.)

The process is remarkably simple. There's no pile to turn. Dig a hole deep enough so that the scraps will be covered with at least

six inches of natural soil. This ensures that by the time the roots reach the buried "time capsule" of nutrients, the scraps have decomposed some, earthworms have begun to digest the garbage, and there's no chance that any clump of high-nitrogen waste is still too hot for tender roots.

Bastard trenching isn't a great way to recycle garden wastes, however. The sheer volume of grass clippings, shrub prunings, leaves, etc., will necessitate digging more trenches than in a war zone.

• Sheet Composting

If you're not using kitchen waste loaded with meat scraps, sheet composting is an even easier way to improve garden soil without strenuous digging and time-consuming turning. Sheet composting refers to thin layers of compostable material laid out over the soil, much like a mulch. The method is very similar to Ruth Stout's deep mulch method. (Ruth Stout was the "grande dame" of the deep-mulch approach to gardening. Her classic book, *How to Have a Green Thumb Without an Aching Back*, was published in 1955.) By layering high-carbon wastes (straw, wood chips, cornstalks, dried leaves) with nitrogenous plant refuse, you construct a two-dimensional compost "pile" of any shape up to one to two feet deep (I usually layer the sheet compost to six to eight inches).

Sheet composting doesn't generate any heat or kill any weed seeds, diseases, or pathogens. But with a good-looking mulch on top (a conventional garden-center variety will do), it slowly helps



Bill Mollison at the Farallones Institute Rural Center planting seedlings in sheet compost.

improve soils from the top down, while allowing you to quickly dispose of large quantities of compostable materials.

Eight years ago, I helped my friend Greg Archbald sheet compost a section of his garden. We layered straw and dairy manure with weeds and a few kitchen scraps and covered it with a more attractive layer of nearly weed-free "washed solids" (the fiber left over after washing manure from dairy stalls). He did nothing for eight years other than water, harvest a few wild edible plants, and watch nature's diversity of plants, insects, and birds colonize the area. This past summer, Greg decided to finally dig the soil and convert the area into an extension of the nearby flower border. He called to let me know that, whereas the soil had been hard and crusty, he was now able to dig it with minimal effort. He was amazed at how the soil had improved.

Sheet composting can also be useful in the short term. You can add layers of sheet composting around existing perennial plants and shrubs. (Don't pile any of the layers against the trunks of established plants or you may have problems with stem and crown rot.) The sheet composting will act as a mild, one-time fertilizer for the perennials, as well as a moisture-conserving mulch.

For annual plants, layer the entire area, moisten all layers, and let the sheet compost "mellow" for a few weeks. Then you can transplant seedlings by either pulling aside some of the sheet compost where you want to plant, or by adding a pocket of potting soil into the sheet compost for each plant. While the plants are growing, the sheet compost makes a small dose of nutrients available with each irrigation and acts as a mulch. After one season of growing vegetables in a sheet mulch, you can turn all the material into the soil to improve tilth and nutrition. This seasonal composting technique is a way to rapidly incorporate large amounts of organic matter into your soil — and get rid of a lot of non-meat kitchen scraps and garden refuse.

• Worm Culture

After I left the Farallones Institute, I started to work on my book *Designing and Maintaining Your Edible Landscape — Naturally*. My enthusiasm for composting was eclipsed by the busy realities of my new life in publishing. It was also dampened by the fact that where I live now is a long way from a good source of manure. I didn't want to take the time to construct hot compost piles while writing and publishing the book. At first, I made a compost heap with a cylinder of snow fence. But as my garden was quite new, I wasn't generating enough garden refuse for even a heap, much less a hot pile that could break down kitchen scraps. I needed an alternative. Worms came immediately to mind.

I'd spent nine months living and working with Ken and Barbara Kern (authors of *The Owner-Built Homestead*) near Yosemite National Park. Ken was a major proponent of worms as waste digesters. He used them to devour garden waste as well as animal and human manures. He sung the praises of worms as decomposers and the speed at which they consume wastes.

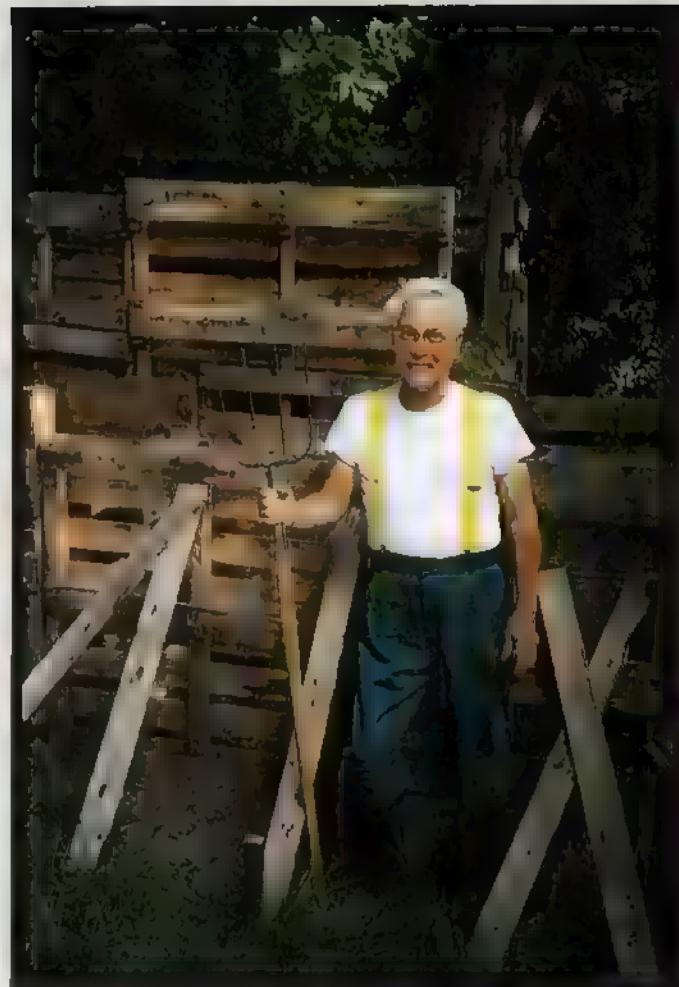
I proceeded to construct a simple worm bin solely for my kitchen scraps. I layered an abandoned Army-surplus drum that had a tight-sealing lid with manure and a six-inch layer of straw mulch, and watered the entire bin. In about a month, after the manure had started to compost the straw, I added a large coffee can's worth of red-wiggler-manure-worm bin substrate (a mixture of manure worms and their castings, the discreet word for worm poop). Shortly thereafter, I started adding kitchen scraps on a daily basis.

The first lesson I learned was that I should've waited for the worm population to increase. There weren't enough worms in the bin to quickly digest each day's waste. After several months, the

HOW TO BUILD A BIN

My Dad was trained as an engineer and has always looked upon science as a firm, reliable basis for much of modern life. He's always used the most modern, chemical-based gardening products. For years, he looked upon my organic escapades as near-science at best — until he started to visit my California gardens and my clients' landscapes. It was the highlight of my compost-crusader period to get a phone call from Dad saying that he'd started building bins to compost autumn leaves! I think it was the tidiness of my compost bins he really liked, but in any case he taught me a thing or two.

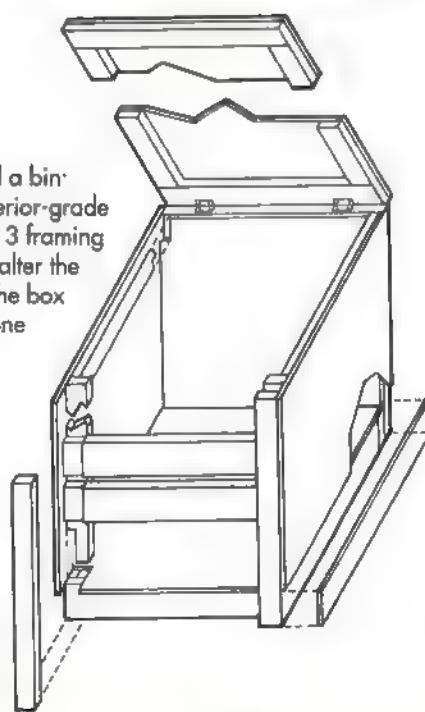
I used to build my compost bins out of heart redwood. This is a grade of redwood lumber that is extremely resistant to decay and rot — a very important consideration in a compost bin. (Cheaper redwood lumber can be identified by its streaks of white sap wood.) The sides of my bins measured about 36", but I increased the height to four feet so that once the initial pile settled, it would still be about three feet high. That way, the entire pile would meet the requisite one-cubic-yard minimum. I treated the inside of the boxes with Thompson's Water Seal because the manufacturer told me that, while he couldn't divulge the product's ingredients, it contained no toxic compounds. For lids, I used a half-sheet of exterior plywood painted on all sides with quality exterior latex paint. Each box required over \$100 worth of redwood



Dad, the "captain of compost" of Olivette, Missouri, used free pallets for his bins.

Illustration: Oliver Younce

One way to build a bin:
Use half-inch exterior-grade
plywood and 2 X 3 framing
lumber. You can alter the
dimensions, but the box
must be at least one
cubic yard for
hot composting.



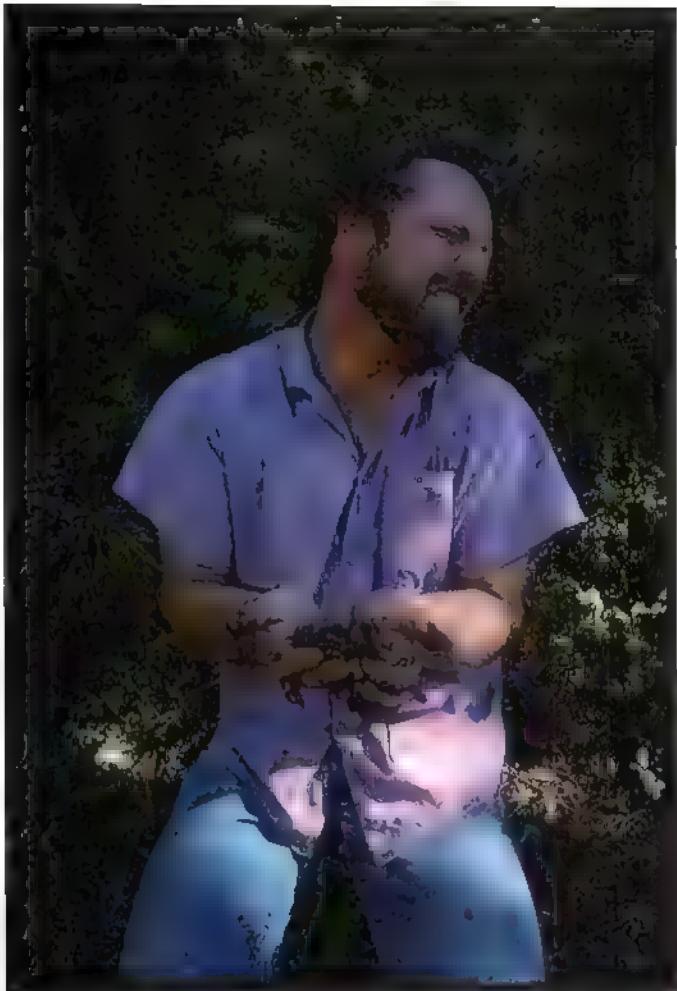
(in 1978 dollars). Not cheap, but the best material for the job.

Being a resourceful guy, my Dad decided to use free pallets instead of expensive, solid redwood walls. He gathered pallets from various loading docks to make the walls of each bin. He alternates six-to-eight-inch layers of leaves with two-inch layers of horse manure with bedding sawdust and adds high-nitrogen 30-0-0 fertilizer when a pile doesn't heat up enough.

At first, he made only two bins. Today, after seven years of leaf composting, in the same dedicated and ambitious style he's brought to everything in his life, he has six bins, with a total capacity of 22 cubic yards — nearly half the size of a small garage! He's certainly the "captain of compost" of Olivette, Missouri (Muh-ZUR-uh).

Moral of the story: You don't need designer materials to build a good compost bin. You certainly don't need one of those expensive, off-the-shelf models.

— Robert Kourik



Author Robert Kourik isn't really afraid of long, slimy, snake-like things. He's just pretending to react the way the rest of us do.

worm population had increased enough to get the job done. Experienced wormologists feed their new worms manure or coffee grounds for a month or two to build up the population. Only then do they even think of feeding their worms with kitchen scraps.

Then, tragedy struck. I had a large barbecue and the lid on my worm drum was left slightly open. The massive amount of scraps from the BBQ, combined with the larvae of flies, literally caused a "meltdown"—the bin turned into a wet, near-slurry of castings, drowned worms, and fly maggots. Not a pretty picture. I drained the surplus liquid off by puncturing small holes in the bottom of the drum. But it took more than four months for the worms to repopulate the bin and the fly larvae to die off.

Then a second tragedy struck. My landlady (a new one) cut down the large shade tree that had shaded the drum. The first heat wave turned my drum into a casserole of baked worms. Again, it took months for the few worm survivors to re-colonize the drum. Many months later, I'm back to a healthy, happy drum of hungry, wriggly worms.

When the editors of this magazine asked me how people with very little property could compost kitchen wastes, my answer was that everyone can grow worms, even in bins in their basements. Their reaction: "Eeeew, worms... how gross!" In spite of my own mistakes with worms, I say to all the readers and editors of the world: "Worms are one of nature's grand cultivators and decomposers. Worms are incredible creatures with fascinat-

ing habits. Learn to love worms!"

Some people may need years of therapy to get beyond their fear of long, slimy, snake-like things. Once you learn to appreciate worms (you don't really have to love 'em), your garden will be happier. Even better, worm culture is the easiest way I know to recycle kitchen scraps.

How does worm culture work? You can begin with just about any container that can be drained and covered to exclude all flies. My Army-surplus drum was two feet high and three feet wide. You can use shallow wooden boxes of any length or width, but no more than 1.5 feet deep. The bigger your family, the bigger the bin you'll need. Be sure to add weatherstripping to the lid to keep out flies. Keep the worm bin where it won't get hot (below 80 to 85 degrees F) and won't freeze. Since a worm bin produces no odors whatsoever, a convenient place for the bin is your basement or garage.

You can't use any old worm. The worms that thrive in garden soil are not suited to the high-nitrogen environment of the bin. The best worms for bin culture are manure worms, *Lumbricus rubellus*. Often sold as red-wiggler fishing worms, these prolific guys (and gals) can double their population in two months. Gardeners with established worm bins usually are only too happy to share some of their wriggling friends. To start, you need a two-pound coffee can's-worth of worms at a minimum. Some experts recommend a starter batch of 12 pounds of worms, their bedding, and castings, or about 15,000 worms. Most gardening magazines have classified sections that advertise mail-order worms. (These ads often promise financial salvation via worm ranching; you're better off with lottery tickets.)

Once you start adding kitchen scraps, it's important to keep the bin dark so the worms stay near the surface, moist and continuously well fed. Don't bother to add citrus rinds, as they're not a worm's favorite food.

Technically, you won't be getting compost from your worm bin. You'll be harvesting the surplus worm, er, manure. The easiest way to gather this stuff is to remove as many worms as possible from the top of the bin, along with the freshest kitchen scraps, and set them aside in a bucket or wheel barrow. (Use a garden digging fork to keep as many worms as possible intact.) The remaining castings make a nutrient-rich fertilizer for all plants. Refill the bin with a thick layer of straw, some fresh manure, and the bucketful or wheelbarrowful of worms. For more guidance, consult Jerry Minish's classic, *The Earthworm Book* (Rodale Press, 1977).

• CHOOSING THE SYSTEM FOR YOU

In short, there are a number of reasonably simple ways to recycle kitchen scraps and garden wastes. The first step is to decide realistically how much time you can devote to gardening and composting. From the various approaches, pick and choose the technique or combination of techniques that best suits your lifestyle, your yard, and your own temperament.

Whether your personal approach ends up being hot and steamy or serpentine and slimy, your garden will appreciate the compost or castings. And your local landfill will be all the smaller for it.



Robert and his wriggly worms.

C O M P O S T I N G T E C H N I Q U E S

TYPE	ADVANTAGE	LIMITATIONS	BEST APPLICATION	MATERIALS NOT TO USE
Hot Compost in Piles	Kills weed seeds & pathogens; rapidly decomposes waste; relatively odorless; good conservation of nutrients; excludes vermin & flies; compost is easily assimilated by soil; can transplant sooner after filling in; produces rich organic matter	Lots of effort; requires plenty of raw material; hard on the back; needs weekly attention	Ambitious, strong-bodied gardeners with plenty of gardening time; best for gardeners whose mates are chiropractors or masseurs	Beginners should avoid citrus rinds; no tobacco
Hot Compost in Bins	All of the above, plus boxes guarantee no vermin or flies; lid keeps rain off pile; tidier; more aesthetic; works better in slightly cooler climates	All of the above, plus boxes can be costly	Where space is limited & aesthetics are important	Beginners should steer clear of citrus rinds; no tobacco
"Compost" Heaps	Easier to throw together; don't require any attention to detail; can be built over a long period of time	Slow to decompose; can harbor vermin & flies; don't conserve greatest amount of nutrients; the result is more fiber than rich organic matter; can make your place look trashy	Hidden from view; great for workaholics with minimal time for composting but large amounts of garden waste; I suggest building it on your neighbor's property	No citrus rinds; tobacco; onion & garlic skins; meat, poultry, & fish scraps; dairy products
Off-the-Shelf Compost Drums	Neat, tidy; give the garden that high-tech touch	More "incineration" than true composting; small volume; costly	Small yards of wealthy gardeners	All of the above
Bastard Trenching	Cheap; easy; no maintenance; little effort required	Hard on the lower back; must have plenty of space that's unplanted	To start a new garden or landscape; for busy gardeners	Need not exclude anything (except TVs, stripped cars...)
Sheet Composting	Cheap; easy; requires little effort	More strenuous than bastard trenching; not suited to an established landscape garden; not a way to recycle kitchen scraps; must be covered with an attractive mulch	New landscapes or gardens, or to mildly fertilize established perennials, trees, & shrubs	Kitchen scraps; absolutely no meat, poultry, & fish scraps & citrus rinds; tobacco; best for garden & lawn clippings
Worm Bin	Easy; neat, tidy; not smelly; makes high-quality fertilizer; can be used "fresh" as soil amendment or as a fertilizer mixed in water; good source of hard-to-get organic phosphorous	Takes a month or two for worms to become established before scraps can be added; not suited to garden or lawn clippings; may provoke a Freudian reaction	For busy people or those with little property, who still want to recycle their kitchen wastes	No citrus rinds; no tobacco

ANTIDOTES TO THROWAWAYS



Reviewed by **Ginia Bellafante**

Reusable Bags

Gone are the days when boxboys packed groceries neatly into biodegradable paper cartons that ended up in roomy landfills. Visit the local market today, and you're likely to walk out with double-bagged sacks constructed of high-density polyethylene, a plastic made primarily from ethylene gas.

While insisting on paper bags at the checkout counter may ease your conscience, it is unfortunately not going to address the garbage glut. Paper bags also end up in cramped landfills, where *nothing* decomposes quickly.

The French have discovered a smarter, and chic, way to shop — expandable string bags made of cotton netting (pictured left). These cream-colored carry-alls will hold about six pounds of groceries and survive countless trips to the market. Rowoco Inc.

is now importing them. They're available at upscale houseware and gourmet stores nationwide for about \$7.50.



Natural Moth Repellents

Using ordinary mothballs to deter the pests may be hazardous to your health. Made of 100% paradichlorobenzene, a volatile chemical, mothballs can cause severe irritation to nose, throat, and lungs, and may induce depression as well as kidney and liver injury over periods of prolonged exposure. Mothball vapors are readily absorbed by clothing and bedding, making exposure very direct. What's more, mothballs pose a serious risk to children, who may swallow the sugar-textured objects.

There are several ways to repel moths naturally. Lavender and rosemary have been used for this purpose for centuries. The Herb Patch Ltd. in Middletown Springs, Vermont, combines those tried-and-true favorites with tansey, peppermint, and other herbs, spices, and plant oils in cotton pouches that can be placed in bureau draw-

ers, trunks, or closets to keep moths away for up to one year. Boxes of eight pouches are available from the Vermont Country Store for \$9.95. Write to the Mail Order Office, P.O. Box 3000, Dept. GM, Manchester Ctr., VT 05255, or call (802) 362-2400 for a free catalog.

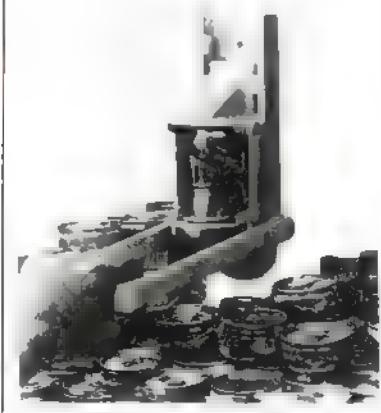
Using cedar is another traditional way to chase moths. Oils found in this wood help repel female moths from laying eggs. (The eggs hatch into hungry moth larvae.) Cedar also helps stop the spread of mildew. Lillian Vernon makes cedar balls and packages them in sets of 30 for \$12.98. The cedar balls can be placed in and around garments and linens in closets, chests, and drawers. Call (914) 633-6300 for a free catalog or write Lillian Vernon at 510 South Fulton Avenue, Dept. GM, Mt. Vernon, NY 10550.

Office Recycling Systems

At the end of a working day, you're likely to find more than one overflowing trash can in a typical American office. Rummage through those cans and you'll uncover mounds of computer paper, stationery, and soda bottles — all recyclable.

Bag Connection Inc. and Diversified Recycling Systems have designed containers that make recycling at work practically effortless. Bag Connection's "BAGIT" (pictured above) is a woven polypropylene bag that slips onto a freestanding metal holder or wall rack. These bags should be placed adjacent to desks and copy machines and labelled with the name of the material to be collected. The "BAGIT" is washable and won't scratch or harm office walls or furniture. Bags are available in three strengths (regular, high density, and super-high density) and cost \$1.17 to \$2.75 per bag. Racks range in price from \$5.95 to \$14.95. Call the Bag Connection at 1-800-62-BAGIT for the name of a supplier in your area.

Diversified Recycling makes a full line of cardboard and plastic recycling bins for floors, shelves, and desk tops in a variety of colors. Write or call Diversified for a catalog: 5606 North Highway 169, Dept. GM, New Hope, MN 55428; (612) 536-6664.



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Healthy House Catalog™

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- PRODUCTS • SERVICES • INFORMATION SOURCES •

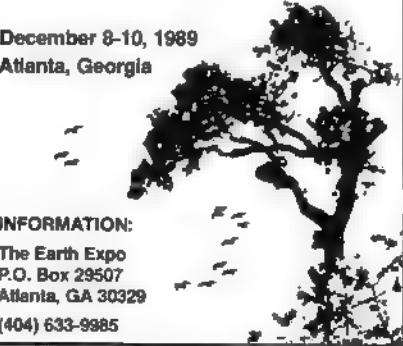
To order your copy of the 1990 Healthy House Catalog, (available November, 1989) send \$19.95 + \$3.00 postage and handling to EHW, Dept. G, 4115 Bridge Ave., Cleveland, OH 44113.

Produced by the non-profit information centers Environmental Health Watch and Housing Resource Center.

The Earth Expo & Eco-Action Conference

Beginning its tour of seven major cities, The Earth Expo is a trade show devoted exclusively to ecologically correct products and services. The Eco-Action Conference features over 20 workshops led by nationally-known authors and environmentalists including John Robbins, "Diet For A New America"; Peter Tompkins, "Secrets of The Soil"; Deborah Lynn Dadd, "Non-toxic & Natural" and "The Nontoxic Home"; Hallie Iglesias Austin, "The Next Step: Beyond Overwhelm To Environmental Action" (Dec. 1989); Lewis Regenstein, "How To Survive In America The Poisoned" . . . plus others addressing the rainforests, recycling, the greenhouse effect and more! This event, sponsored by "InHealth Magazine", is in part a benefit for local/national environmental groups

December 8-10, 1989
Atlanta, Georgia



INFORMATION:
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MR. RUMPLES RECYCLES

Written and illustrated by Barbara Anne Colharpe

A delightful storybook (K-6) that teaches children how to recycle at home and school. Entertaining and imaginative, the story introduces Mr. Rumples, the neighborhood enigma, and three children who have long been curious about his strange ways. In addition to learning that older people are fascinating without being fearsome, children learn about recycling household and yard wastes.

A subject of global concern, author-illustrator Colharpe projects the vital matter of recycling in a manner to grasp a child's interest and attention. Aimed at ensuring the Earth's future and instilling healthy, lifelong habits, Mr. Rumples Recycles is a must for every child.

For gifts, 1000 copies with organization/address imprinted on back cover, \$3.69 @, shipped C.O.D. Please prepay. Other quotes on request.

Specifications: Soft cover, 8 full color/22 black and white illustrations, 8½" X 11", 30 pages.

(Ms. Colharpe is nationally recognized in the field of waste reduction.)

ORDER FORM (Enclose check or money order)

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Send _____ copies of Mr. Rumples Recycles \$5.25@ (includes shipping costs).

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Organic Baby Food

When the national environmental group Natural Resources Defense Council released a report indicating that pre-schoolers are at a particularly high risk of developing cancer from pesticide residues in food, many parents started to take a hard look at what they were giving their kids to eat. The fruits, vegetables, and grains used in conventional baby foods are typically sprayed with toxic pesticides and growth enhancers, then processed with chemical additives.

Long before the eye-opening report caught the attention of the press, two fledgling companies began producing baby and toddler foods using only fruits, vegetables, and grains grown without synthetic pesticides, herbicides, or fungicides. Earth's Best, based in Middlebury, Vermont, and Simply Pure of Bangor, Maine, each purchase produce exclusively from organic farms that have been chemical-free for a minimum of three years, and certified as such by an appropriate certification organization. In addition, Earth's Best routinely performs its own on-site soil tests to make sure farmland is free of pesticide residues. Both



companies use no salt, sugars, tapioca, concentrates, or preservatives.

The Earth's Best line includes fruit and vegetable purees, juices, and whole-grain cereals. Simply Pure features strained fruits and veggies for babies, diced greens for toddlers, and a multi-grain porridge. The cost of feeding your baby untainted food:

about two-and-a-half times higher than the price of standard baby foods.

Earth's Best and Simply Pure baby foods are available in health-foods stores nationwide and through local diaper services. Or order by mail from the Walnut Acres Natural Foods Catalog, Dept. GM, Penns Creek, PA 17862; (717) 837-0601.

Safe Paints

A study by Johns Hopkins University four years ago found over 300 toxic chemicals in household paints. One hundred fifty of these are probable carcinogens, while others have been linked to depressed brain function, including slow reflexes and loss of alertness. Although extremely toxic substances such as cadmium, xylene, toluene, and formaldehyde are frequently found in paints, they're often not listed on the labels, but referred to as "inert ingredients," "additives," and "petroleum distillates" instead.

Many chemically sensitive people who cannot tolerate the various synthetic substances found in ordinary paints have turned to the natural plant- and wood-oil-based paints manufactured by German companies Auro and Livos. As more and more evidence points to the dangers of conventional paints, these products are gaining an almost mainstream appeal. Pine resin, linseed oil, chalk, india rubber, and mineral-derived pigments are the ingredients used in these paints, which come highly recommended by architects and builders, who claim they are more durable than some



conventional paints.

Both manufacturers make enamels and flat paints for interior and exterior use. For more information on where to purchase these products locally, contact Sinan Com-

pany (Auro's U.S. Distributor), P.O. Box 181, Dept. GM, Suisun City, CA 94585; (707) 427-2325; and Livos PlantChemistry, Dept. GM, 2641 Cerrillos, Santa Fe, NM 87501; (505) 988-9111.

EMISSION PERMISSION

Conservation Law Foundation (CLF), a nonprofit, public interest environmental law organization, has developed a *model solid waste incinerator permit* to help municipal officials, permitting agencies, citizens, and incinerator builders and operators.

CLF's model permit addresses equipment, facility design, operating procedures, emission standards, ash handling and disposal, and other necessary requirements to *minimize the threats solid waste incinerators may pose to human and environmental health.*

We know the issues.

Conservation Law Foundation's technical and legal staff work to resolve the complexities of solid waste management. We promote an integrated regionally coordinated policy — one which emphasizes source reduction and recycling and ensures that disposal facilities are sited and regulated to minimize environmental threats.

You need to know.

- Please send me a copy of CLF's Model Municipal Solid Waste Incinerator Permit.
I have enclosed \$10.00 which includes postage and handling.
- Please send me information on CLF membership and the Solid Waste Project.

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MAIL TO: CLF, Department G, 3 Joy Street, Boston, MA 02108,
or call Elaine Lawrence at (617) 742-2540

Conservation Law Foundation

3 Joy Street, Boston, MA 02108 (617) 742-2540

Hand Power

Many of you have been writing letters requesting us to review hand-powered alternatives to La Machines, Cuisinarts and other energy-draining appliances that perform kitchen wizardry. We asked Ken Stevens, an industrial designer who specializes in restaurant and hotel kitchenware, to cook up the following piece on three well designed—and energy efficient—tools popular among chefs and home gourmets.

—the editors

A little over 10 years ago, the Cuisinart food processor led what seemed to be the final "power conquest" of the kitchen. Delighted by the speedy miracles it performed, many cooks consigned their trusted, manually operated gadgets to the basement or the trash bin. The small-kitchen-appliance business is today fueled by a near-insatiable consumer demand for electric tools.

Despite the gizmo craze, a small contingent of kitchen purists has remained faithful to super-efficient and obviously energy-saving devices such as chefs' knives and

Chinese cleavers. True cooks have two beefs against certain uses of electric appliances. One, they are exercises in overkill. Consider the work involved in employing a food processor to chop half an onion: Work-bowl, blade, top, and pusher all need to be washed for a task that takes about 10 seconds to perform. Two, unless carefully monitored, the processor will turn out an onion slurry, not finely chopped pieces.

Fortunately, there are some excellent, time-saving hand-operated kitchen tools on the market:

Home Mandoline ▶▶

Moha, a Swiss hardware company, manufactures a version of the French mandoline, the classic countertop tool for slicing and shredding. Vegetables are held by hand or under a gripper and slid back and forth across the blade.

Made of stainless steel and plastic, the mandoline slices in three thicknesses (spacer guides snap in to adjust cutting size). The metal fingers shred in julienne and thicker strips. To clean, you simply sponge off. The Moha mandoline is available at gourmet specialty shops and by mail from Tarzian West, 194 Seventh Avenue, Dept. GM, Brooklyn, NY 11215; (718) 788-4213 for \$29.

**Professional Mandoline ▶▶**

Gourmets may opt for the professional's mandoline, made completely of stainless steel and capable of cutting vegetables in an infinite variety of sizes. A lever on the bottom of the instrument adjusts blade spacing to cut to desired size.

Unlike the Moha version, the professional mandoline can produce intricate "waffle" or criss-cross patterns for fancy dishes. It stands 10-1/4" tall, 4-1/4" wide and 15-1/2" long, and should last a lifetime.

This superbly designed tool is pricey: It's available for \$120 via UPS from: Bridge Kitchenware Corp., Dept. GM, 214 East 52nd Street, New York, NY 10022; (212) 688-4220.

**Moha Chopper**

Moha has also recently introduced a spring-loaded chopper for onions and other vegetables. Manual pressure placed on top of the instrument forces a zig-zag blade to cut vegetables in a contained cylinder. The blade automatically rotates about 15 degrees with each successive push. And the device is easily cleaned. Look for the chopper at gourmet specialty shops or order by mail from Tarzian West (see address above) for \$17.59.



—text and photos by Ken Stevens



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3

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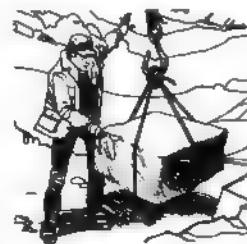
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The Rights of Nature: A History of Environmental Ethics

by Roderick Frazier Nash. 290 pages, The University of Wisconsin Press, 114 North Murray Street, Madison, WI 53715. \$27.50 ppd.

If you read many environmental magazines, you've probably noticed increasing mention of a new wave of environmental thinking called "deep ecology." Those who subscribe to it criticize American culture, including most environmentalists, for being too anthropocentric, for considering humans the measure of all value. Deep ecologists believe that nature has intrinsic value and an ethical status equal to that of humans. This type of thinking is also called "biocentrism."

Roderick Nash, a professor of history and environmental studies at the University of California, considers the rise of deep ecology a natural outgrowth of the liberal thinking that is at the heart of Western philosophy. He also argues that natural rights philosophy is quintessentially American.

Nash isn't dogmatic. His purpose isn't to convince readers that pitcher plants and harp seals have rights equal to those of people. Rather, it's to place the environmental movement and deep ecology, one of its more radical wings, in the context of Western intellectual history.

The book is organized into six chapters, each exploring the influence of ecology, philosophy, religion, and other disciplines on the environmental movement. Nash also introduces readers to Aldo Leopold, Rachel Carson, John Muir, Christopher Stone, Peter Singer, and other shapers of modern environmentalism.

The discussion of Leopold's 1949 environmental classic, *A Sand County Almanac*, is particularly meaty. Nash considers Leopold's book far more than just another quaint collection of nature essays. He argues that it is a manifesto on the need to restrain the basic American impulse to exploit the environment for maximum economic gain. In another superb chapter on the greening of religion, Nash explores the environmental implications of Jewish and Christian beliefs and the attempts of some contemporary philosophers to rethink Western religion's traditional teaching that creation exists solely for human benefit.

Even if you disagree with Nash's fundamental thesis, the book is worth reading for its insights into the historical origins of

environmental thinking. And the book is extremely well documented. Its extensive bibliography and suggested reading list are an excellent starting point for further ruminations on environmentalism.

—Bruno R. Tedeschi

The Planet of Trash: An Environmental Fable

by George Poppel. illustrated by Barry Moyer. 27 pages, National Press Inc., 7508 Wisconsin Avenue, Bethesda, MD 20814. \$11.20 ppd.; \$11.76 ppd. for Maryland residents.



This futuristic fable for children age 12 and under describes the journey of extraterrestrial sleuths to a mythical planet in the year 2,052. Their mission? To discover what happened to a polluted, lifeless place aptly named the Planet of Trash. As the aliens go about collecting samples of filthy air, soil, and water, they uncover mountains of ash, junked cars, and old soda bottles. Appalled by their findings, the sleuths realize the planet choked to death on dirt and waste.

Like all fables, *The Planet of Trash* leaves readers with a clear message. Lively illustrations and text composed in rhyme tell kids to pick up trash, avoid littering, and start recycling. *The Planet of Trash* is instructive enough to use in schools and fun enough to give to small friends this Christmas.

—Ginia Bellafante

BioCycle: Journal of Waste Recycling

Monthly magazine published by JG Press, Inc., Box 351, 18 South Seventh Street, Emmaus, PA 18049. Subscription: one year (12 issues) \$55; two years (24 issues) \$89.



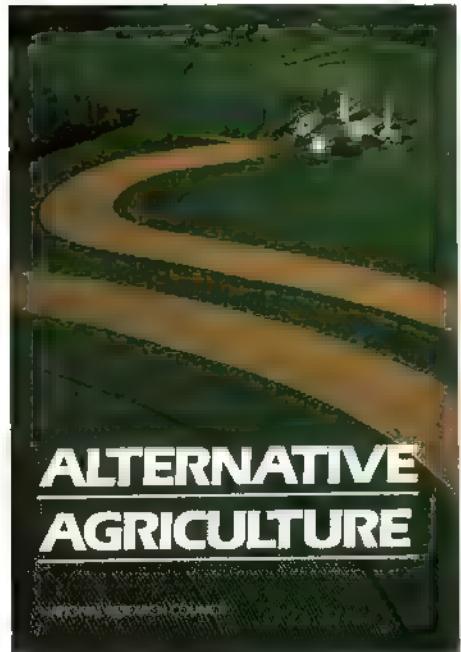
We have a confession to make. Believe it or not, there's another magazine out there devoted to our favorite subject — garbage. Theirs is an established trade publication for waste managers. For nine years, *BioCycle: Journal of Waste Recycling*, has been filling its pages with informative articles on composting, trash and sludge recycling, and other environmentally sound waste management techniques. The magazine showcases innovative programs around the country and worldwide, and grapples with the economic and political questions involved in building and managing waste facilities. Recent titles include "State of the Art of Composting in Japan" and "How to Get Results in Residential Recycling." Regular departments feature national and regional news and upcoming trade conferences around the world.

Other trade magazines focus on pieces of the solid waste business. *BioCycle* looks at all our waste problems as an integrated whole. And nobody beats *BioCycle*'s coverage of municipal composting, efforts to recycle sewage sludge back on the land, and other biological approaches to waste management.

—Ginia Bellafante

Alternative Agriculture: A report from the National Research Council

448 pages, National Academy Press, 2101 Constitution Avenue, NW, Washington, DC 20418. Hardcover, \$29.95 ppd; softcover, \$19.95 ppd.



Growers and policymakers who insist that chemically-intensive farming is the only way to yield bountiful crops and big profits will find this long-awaited study from the National Research Council's Board on Agriculture rather disconcerting. The 17-member expert committee that compiled the report studied the impact of alternative agriculture on the nation's economy, environment, and public health. Eleven case studies describe in detail successful alternative farming systems in the United States.

The committee believes that wider adoption of farming methods that minimize the use of pesticides, and that employ biological pest controls and pest-resistant crop varieties would pay off in bigger profits for farmers and a healthier environment. The National Research Council calls for an end to federal farm policies that penalize growers who adopt alternative practices. It also recommends that the U.S. Department of Agriculture spend more money on research in alternative farming.

—Ginia Bellafante

A Citizens Guide to Plastics in the Ocean

by the Center for Marine Conservation
131 pages, 1725 De Sales Street, NW,
Washington, DC 20036. \$2 ppd.

We're finally learning that the oceans aren't the boundless garbage dumps we once hoped they were. As the Center for Marine Conservation puts it in this resourceful little book, "The rapid increase in the last 5 years of the production and application of plastic has brought this home in ugly and disturbing ways": Syringes and plastic tampon applicators wash up on beaches. Seals and seabirds strangle in plastic six-pack holders. Sea turtles choke on plastic bags, mistaking them for jellyfish.

The *Guide* tells us how all this plastic debris wreaks havoc in the ocean environment — and what we can do about it. The advice is upbeat and friendly. Lists of government and private groups active in ocean pollution around the globe are appended for those who live in coastal areas and want to get more actively involved.

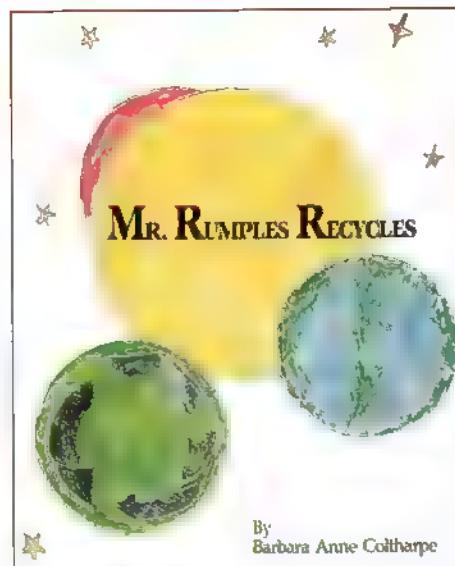
—Janet Marinelli

Resource-Efficient Housing Guide

by Robert Sardinsky. 127 pages, Rocky Mountain Institute, 1739 Snowmass Creek Road, Snowmass, CO, 81654. \$15 ppd.

Compiled by the Rocky Mountain Institute, a Colorado-based environmental research organization specializing in resource conservation, this book is a comprehensive guide to building and maintaining houses in cost-efficient and ecologically sound ways. A great source for any homeowner, it lists and annotates books, periodicals, universities, and associations that will help you make the most of the resource-efficiency opportunities that exist in the home you're designing, building, or already living in. The book will lead you to sources that can show you how to construct a home making the most of the natural resources on your land, conserve water and energy, and protect household environmental quality.

—Ginia Bellafante



Mr. Rumples Recycles

by Barbara Anne Coltharpe. 25 pages, Hyacinth House Publishers, P.O. Box 14603, Baton Rouge, LA 70898. \$5.25 ppd.

When three pals lose their kite in a neighbor's backyard, they learn some valuable lessons from an old man thought to be the town crackpot. The odd-looking bins Mr. Rumples keeps behind his house are actually compost heaps. Mr. Rumples teaches the kids about composting and recycling, and they all leave happily embracing his motto: "stash it not trash it." The book is perfect for kids grades kindergarten through sixth

—Ginia Bellafante

Earthbeat

30-minute weekly television series, Super-Station TBS.

Earthbeat touts itself as the first international television series devoted to presenting positive solutions to today's environmental problems. It debuted on the TBS cable network on October 15. The show's three-part format features a fast-paced news segment, an in-depth profile of an individual, group, or corporation actively involved in bettering the environment, and a short profile on one person whose actions have already made a difference

Watch for Earthbeat on Sundays at 11 p.m. Eastern Standard Time.

—Ginia Bellafante

1. Environmental Tips — A "doer's guide" of ideas for your community that build spirit and use internal resources. Sample newsletter and membership information available. Great for neighborhood groups, civic associations, small towns or families. Free literature. Rodale Institute.

2. The Diaper Solution — This waterproof, washable, all-in-one diaper is the solution to the diaper crisis. The only convenient, economical and ecologically safe alternative to disposable diapers. Also: "The Lost Art of Diapering" pamphlet teaches disposable users how to use Bumkins. Free. Bumkins International.

3. Get A Handle On Trash — This brochure contains tips on handling household waste and trash disposal options, including recycling. Published as a public service by GLAD® Wrap and Bags and Keep America Beautiful, Inc. Single copies free. First Brands Corp.

8. Air Purification — Concerns about indoor air pollution in homes, offices and cars can be put to rest with carbon purifiers, water filters and foil vapor barriers. Constructed according to high standards of environmental integrity. Free literature available. E.L. Foust Company.

10. America's Garbage Crisis — This fascinating text explores how we cope with the abundance of trash that is quickly swallowing our land and polluting our air. "Rush to Burn", 276 pages, is available in paper or cloth. Call (800) 628-2828 to order this text or 48-page catalog. Island Press.

13. Fine Papers — High-quality papers made with certified recycled fiber content are available for stationery, envelopes, copiers, laser printers, newsletters and brochures. Call for information: (617) 277-9901. The Recycled Paper Company.

14. Biodegradable Garbage Bags — These strong bags look and act like plastic, but are biodegradable. Your satisfaction is guaranteed. Call to place an order, (802) 862-2999, or write for 32 page catalog. Seventh Generation. \$2.25

16. Waste Management Consulting — A comprehensive approach to solving solid waste management problems, specifically tailored to your unique needs. Consulting Engineers. For information call: (201) 379-3400 Killam Associates.

18. Indoor Pollution Control Directory — Unique national publication listing hundreds of resources to create a healthy environment in your home. Describes major problems and solutions. Send \$22.95 to EHW, Dept. G, 4115 Bridge Ave., Cleveland, OH 44113. Healthy House Catalog.

19. Rinse Recycle System — Guarantee a source of water for your landscaping. Protect your environment and the value of your property with a Rinse Recycle System. Free brochure. Water Cycle Company.

20. Safe Household Cleaner — Cloverdale cleaner is an environmentally safe cleaner that removes grease, oil, tar, mildew and more. Use on glass, grills, air conditioning ducts, whitewall tires. Call: (413) 528-5200. The Sprout House.

24. Environment Conscious Products — Aluminum can crushers, house-hold products, trash bags, water and air-treatment systems, non-fluorocarbon aerosols, non-animal tested cosmetics. Company presented the UN Environmental Excellence Award. Free catalog. Lakeside Unlimited.

25. Environmental Growth Stocks — Free information on environmental growth companies listed on NYSE, AMEX, OTC and Canadian stock exchanges; free zero coupon bond information. Call J. Patrick Calby at (800) 882-4726, or write for information. Richfield Securities.

26. Can Crusher — Reduce can storage by 5 times, and save trips to the redemption center. Send \$17.95 (includes shipping) to JVT, P.O. Box 4376, Dept 102, Sonora, CA 95370. Call for more information: (209) 532-0755. Jo V Technologies.

27. Solar Heater — This water heater looks more like a skylight, and is designed to work in all conditions in all parts of the country. High performance will save you money. American Solar Network.

28. Freedom Environmental Fund — Combining socially responsible investing with a dominant growth opportunity for the 1990s. Call 1-800-333-2327, ext. 2251 or circle number 28 for free prospectus. Read all material carefully before investing. Free Bear, Stearns & Company.

29. Parnassus Fund — Goes against the established wisdom of Wall Street. Fund follows a "contrarian" policy of investing in stocks that are out of favor with the financial community. Takes social and environmental factors into consideration when making investment decisions. For free prospectus call: 800-999-3505 Parnassus Fund.

30. Environmental Organization — CLF is a non-profit, public interest, environmental law organization founded in 1966. A staff of attorneys and scientists use law to improve resource management, environmental protection and public health throughout New England. Free literature. Conservation Law Foundation.

31. The Trashcycler — Separate your recyclables in an easy-to-use and attractive wire-coated cabinet. Use in your home or office, indoors or out. Call for more information: (518) 426-4987. Better Environment, Inc.

32. Allergy-Free Products — Complete catalog of safe, non-toxic products including cleaners, shampoos, deodorants, paints, foods, and cotton pillows. Also books on allergy prevention, making your home allergy-free, and the food/allergy connection. Free. The Ecology Box.

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United States E.P.A Conference on Hazardous Waste Management
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For registration information, contact GRCDA, Silver Spring, MD.
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Blueprint for a Healthy House
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(216) 281-4663.

For an excellent book on natural gardening systems, **Designing and Maintaining Your Edible Landscape Naturally** by Robert Kourik, write Metamorphic Press, P.O. Box 1841, Santa Rosa, CA, 95402. Hardback, \$24.95, paper, \$16.95.

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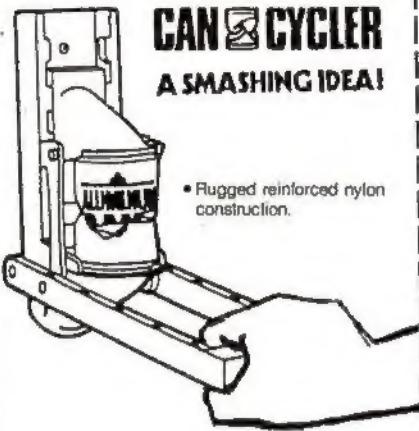
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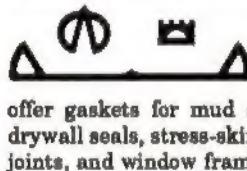
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A REAL STINKER

If you sniffed at the advent of room deodorizers, those sticks and sprays advertisers claim "cover up nasty and embarrassing household odors," you'll snort over Mask-it™, a new "outdoor" deodorizer for home gardeners and professional landscapers troubled by the smell of pesticides. Rockland Chemical, the New Jersey-based manufacturer of lawn and garden products and developer of Mask-it, claims this "faint, pleasant, citrus-scented fragrance" conceals the noxious odor of insecticides, herbicides, and fungicides used on ornamental plants.

Mask-it does nothing to reduce the toxicity of pesticides, so gardeners and landscapers who add the fragrance to their spray tanks are still exposed to potentially dangerous chemicals. And the product does nothing to ensure that pesticides do not contaminate soil or water, or endanger wildlife.

What it does do is cloud the controversy surrounding chemical pesticides. A press release for Mask-it reads, "An unpleasant odor is translated in the public's mind to be vapors of hazardous chemicals"—suggesting that the problem with pesticides is one of public perception, not public health.

How Mask-it, a syrupy, orange liquid that smells about as potent as a lemon Lifesaver, blocks the chemical stench of malathion, diazinon,



chlorpyrifos, and other pesticides it's combined with, remains a mystery. We did some nosing around, but soon learned that the manufacturer protects the identity of its product ingredients as "proprietary information" and a "trade secret." (Unlike the pesticides with which it is mixed, Mask-it is not regulated by the federal Environmental Protection Agency, so this information is not a matter of public record.) What the product label does indicate, however,

is that Mask-it can be irritating to human skin, eyes, throat, and lungs, and may cause allergic dermatitis. Immediate medical attention is required if the liquid is swallowed.

Mask-it apparently masks a lot more than odor, but Rockland says no one's complaining. Marketing executives claim that Mask-it has gotten a warm reception among nursery owners—and also consumers, who are willing to fork out \$91.50 for one gallon.

Illustration: Kathleen Valp



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RESTORATION



Naturalist Roger Tory Peterson once wrote that "man has emerged from the shadows of antiquity with a Peregrine on his wrist." In the hands of falconers, the bird has witnessed "the struggle for civilization, from the squalid steppes of Asia thousands of years ago to the marble halls of European kings in the 17th century." An impressive bird with powerful yellow talons and a strong hooked bill, the Peregrine is a symbol of the relationship between humans and nature.

By 1970, the Peregrine had also become a symbol of our deteriorating environment. The falcon had disappeared east of the Mississippi and was on the verge of extinction in the West. The culprit was the pesticide DDT, which became concentrated in the food chain and accumulated in the Peregrine, a natural predator of insect-eating birds. The result: thin-shelled eggs that couldn't stand up to the weight of Peregrine parents.

DDT was banned in 1972.

In 1974, the first captive-bred Peregrine Falcons were released into the wild by Tom Cade, an ornithology professor at Cornell University and founder of The Peregrine Fund. The falcon has since been restored to former habitats from coast to coast.

The falcons are flourishing in cities, nesting on towers, bridges, and tall buildings, which provide updrafts for their fabled flights. A falcon named Scarlett ensconced herself on the 33rd floor of a Baltimore building in 1977. Since then, "falcon fever" has gripped Boston, Philadelphia, Los Angeles, and other cities, where urban dwellers watch Peregrines soar and loop, and rocket out of the sky at 200 mph to pluck pigeons (the staple of the urban falcon's diet) out of midair. The people who maintain city bridges are delighted. "We're really happy to help this endangered species make a comeback," Stephen Grabowski, who oversees repair work on a New York bridge, told reporters. "But the falcon also helps us. Since the falcon's arrival, we've lost 95 percent of our pigeon population, and we no longer have a starling problem."

By the year 2000, The Peregrine Fund expects a complete recovery of Peregrines in the U.S. The Peregrine, says the Fund, is proof that "we can correct many environmental mistakes."

—Janet Marinelli



A young Peregrine learns to fly.

Top left: After an absence of 40 years, Peregrines are once again nesting on this New Hampshire crag, shown in a photo taken in 1930.
Top right: New York City today.